03D224/280/355PM-1

Aisin Gas Heat Pump

Multi-Unit Model P224/P280/P355

SERVICE MANUAL

Type of Gas / Specifications	Type of Fuel Gas	
	13A□12A	Propane Gas
Standard	TGMP224B2N TGMP280B2N TGMP355B2N	TGMP224B2P TGMP280B2P TGMP355B2P
Salt-damage proof type	TGMP224B2NE TGMP280B2NE TGMP355B2NE	TGMP224B2PE TGMP280B2PE TGMP355B2PE
Winterized type	TGMP224B2NH TGMP280B2NH TGMP355B2NH	TGMP224B2PH TGMP280B2PH TGMP355B2PH
Salt-damage proof/ Winterized type	TGMP224B2NEH TGMP280B2NEH TGMP355B2NEH	TGMP224B2PEH TGMP280B2PEH TGMP355B2PEH

Note:
Products of the salt-damage proof/winterized specifications are produced only on an order basis.

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AISIN SEIKI CO., LTD.

PREFACE

Safety Precautions

The safety precautions to be strictly observed in order to avoid possible damage to persons engaged in the maintenance of the multi-unit P224/P280/P355 and to other persons, are described using the following methods:

In this manual, hazards and damage likely to result from improper maintenance operations are represented using the markings "⚠ WARNING" and "⚠ CAUTION". Be absolutely certain to observe these warnings and precautions.

[Meaning of Markings]

⚠ WARNING This marking is followed by a description of the situation in which failure to observe this warning could result in personal death or serious injury.

⚠ CAUTION This marking is followed by a description of the situation in which failure to observe this precaution could lead to personal injury and/or product damage.

☞ **Before starting maintenance operations:**

⚠ WARNING

1. **Turn off the leakage current circuit breaker located inside the control box of the outdoor unit.**
   – Failure to observe this warning may result in electrical shock.
2. **Close the fuel gas cock.**
   – Fuel gas leakage may induce gas poisoning and/or gas explosion.

☞ **During maintenance:**

⚠ WARNING

1. **Wear the clothes that fit the nature of the work.**
2. **Beware so as not to touch hot sections or rotating bodies.**
   – Touching could result in burns or injury.
3. **Do not apply a valve cleaner to hot sections when cleaning valves.**
   – Failure to observe this warning may result in fire.

☞ **About brazing operations:**

⚠ CAUTION

For brazing, conduct nitrogen gas blowoff using the method specified in the relevant service manual.

– Failure to observe this precaution could lead to pipeline clogging due to the occurrence of oxide scales.

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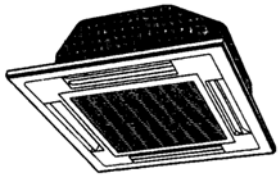
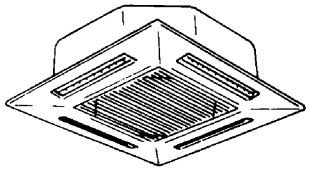
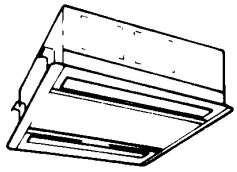
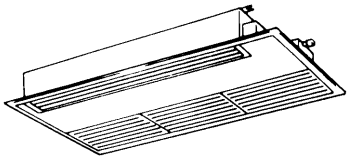
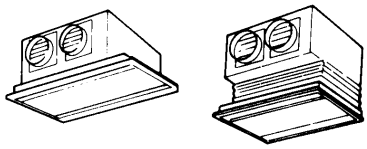
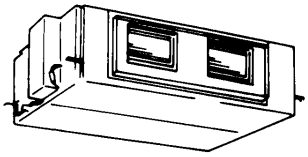
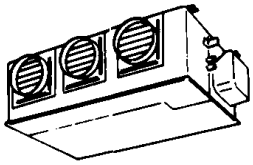
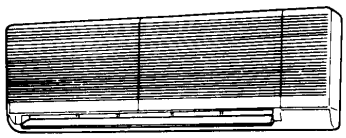
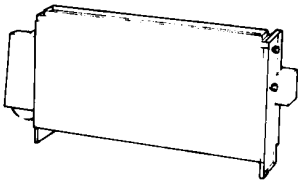
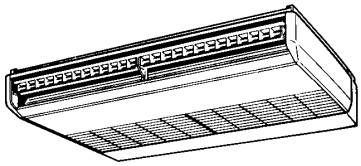
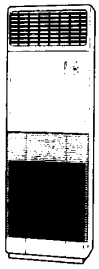
Chapter 1

SPECIFICATIONS

1.1 Product External Views

4-/3-/2-way cassette type FTKTPOOOM5 	4-/3-/2-way compact cassette type TKTCPOOOM5 	2-way cassette type TKTWPOOOM5 
1-way cassette type TKTSPOOOM5 	Built-in cassette type TKRPOOOM5 	Ceiling-embedded high static-pressure duct type TKUPOOOM5 
Ceiling-embedded medium static-pressure duct type TKUMPOOOM5 	Wall-mounted type TKKPOOOM5 	Floor-standing lowboy exposed type TKFLPOOOM5 
Floor-standing lowboy concealed type TKFUPOOOM5 	Ceiling-suspended type TKEPOOOM5 	Floor-standing type TKFPOOOM5 
Outdoor unit TGMP224/280/355** (Note 1) 		

Notes:
1. The double-asterisk symbol (**) denotes a serial code number and differ according to the type of gas used.
2. The triple circle mark (ooo) in model numbers denote a capacity.
3. Other than above, outside-air processing unit with a direct expansion coil unit, air feed processing unit, ceiling-suspended oil-resisting type, floor-standing plenum type, and floor-standing duct type are available.

1.2 Product Specification

1.2.1 Model Number and Product Name

(1) Product name

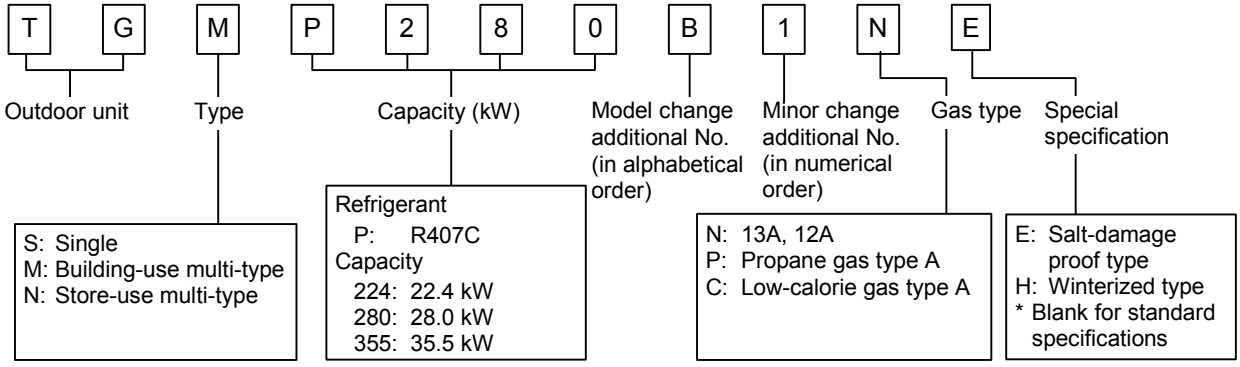
Gas heat pump air conditioner outdoor unit

(2) Model number

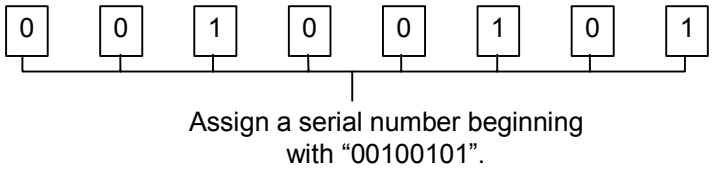
New Refrigerant Building-Use Multi-Unit Model P224 TGMP224∗∗∗
New Refrigerant Building-Use Multi-Unit Model P280 TGMP280∗∗∗
New Refrigerant Building-Use Multi-Unit Model P355 TGMP355∗∗∗

[Description of outdoor unit model number]

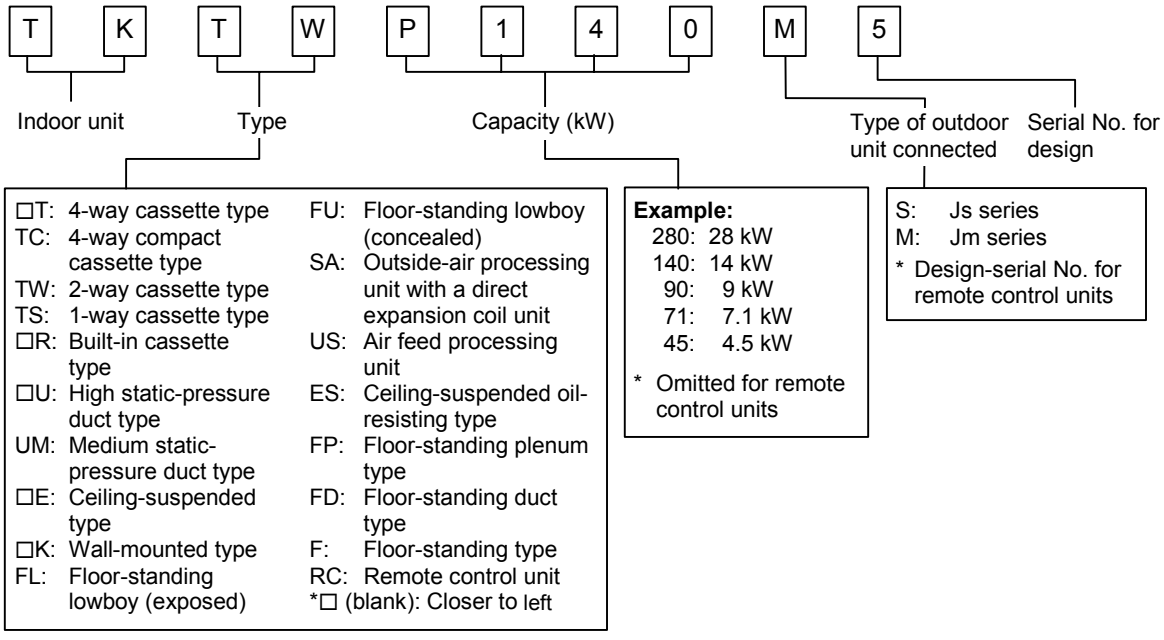
Example: LPG specification(salt-damage proof type); TGMP280B2NE



[Description of serial number]



[Description of indoor unit model number]



1.2.2 Combination of Indoor Unit and Outdoor Unit

(1) Model P224 outdoor unit (TGMP224***)

Type \ Model No.	P22	P28	P36	P45	P56	P71 P80	P90	P112	P140	P160	P224	P280	
	2.2 (kW)	2.8 (kW)	3.6 (kW)	4.5 (kW)	5.6 (kW)	7.1 (kW)	8.0 (kW)	9.0 (kW)	11.2 (kW)	14.0 (kW)	16.0 (kW)	22.4 (kW)	28.4 (kW)
4-/3-/2-way cassette type TKT		○	○	○	○	○	○	○	○	○	○		
4-/3-/2-way compact cassette type TKTC		○	○	○	○								
2-way cassette type TKTW	○	○	○	○	○	○	○	○	○	○	○		
1-way cassette type TKTS		○	○	○	○	○							
Built-in cassette type TKR	○	○	○	○	○	○		○	○	○			
Ceiling-embedded high static-pressure duct type TKU				○	○	○		○	○	○			
Ceiling-embedded medium static-pressure duct type TKUM	○	○	○	○	○	○		○	○	○			
Ceiling-suspended type TKE			○	○	○	○		○	○	○			
Wall-mounted type TKK		○	○	○		○							
Floor-standing lowboy (exposed) TKFL		○		○	○	○							
Floor-standing lowboy (concealed) TKFU		○		○	○	○							
Outside-air processing unit with a direct expansion coil unit TKSA		○		○	○								
Air feed processing unit TKUS								○		○			
Ceiling-suspended oil-resisting type TKES							○			○			
Floor-standing plenum type TKFP										○		○	○
Floor-standing duct type TKFD												○	○
Floor-standing type TKF							○			○			
Capacity available	Outdoor unit capacity ratio: Approx. 50 to 130% (Total capacity of indoor units: P112 to P291)												
Number of connectable indoor units	1 to 12 units												

Note:
The capabilities of indoor units slightly decrease during the simultaneous operation of these units in excess of a 100% outdoor unit capacity ratio.

(2) Model P280 outdoor unit (TGMP280∗∗∗)

Model No. / Type	P22	P28	P36	P45	P56	P71	P80	P90	P112	P140	P160	P224	P280
	2.2 (kW)	2.8 (kW)	3.6 (kW)	4.5 (kW)	5.6 (kW)	7.1 (kW)	8.0 (kW)	9.0 (kW)	11.2 (kW)	14.0 (kW)	16.0 (kW)	22.4 (kW)	28.4 (kW)
4-/3-/2-way cassette type TKT		○	○	○	○	○	○	○	○	○	○		
4-/3-/2-way compact cassette type TKTC		○	○	○	○								
2-way cassette type TKTW	○	○	○	○	○	○	○	○	○	○	○		
1-way cassette type TKTS		○	○	○	○	○							
Built-in cassette type TKR	○	○	○	○	○	○		○	○	○			
Ceiling-embedded high static-pressure duct type TKU				○	○	○		○	○	○		○	○
Ceiling-embedded medium static-pressure duct type TKUM	○	○	○	○	○	○		○	○	○			
Ceiling-suspended type TKE			○	○	○	○		○	○	○			
Wall-mounted type TKK		○	○	○		○							
Floor-standing lowboy (exposed) TKFL		○		○	○	○							
Floor-standing lowboy (concealed) TKFU		○		○	○	○							
Outside-air processing unit with a direct expansion coil unit TKSA		○		○	○								
Air feed processing unit TKUS								○		○			
Ceiling-suspended oil-resisting type TKES							○			○			
Floor-standing plenum type TKFP										○		○	○
Floor-standing duct type TKFD												○	○
Floor-standing type TKF							○			○			
Capacity available	Outdoor unit capacity ratio: Approx. 50 to 130% (Total capacity of indoor units: P140 to P364)												
Number of connectable indoor units	1 to 12 units												

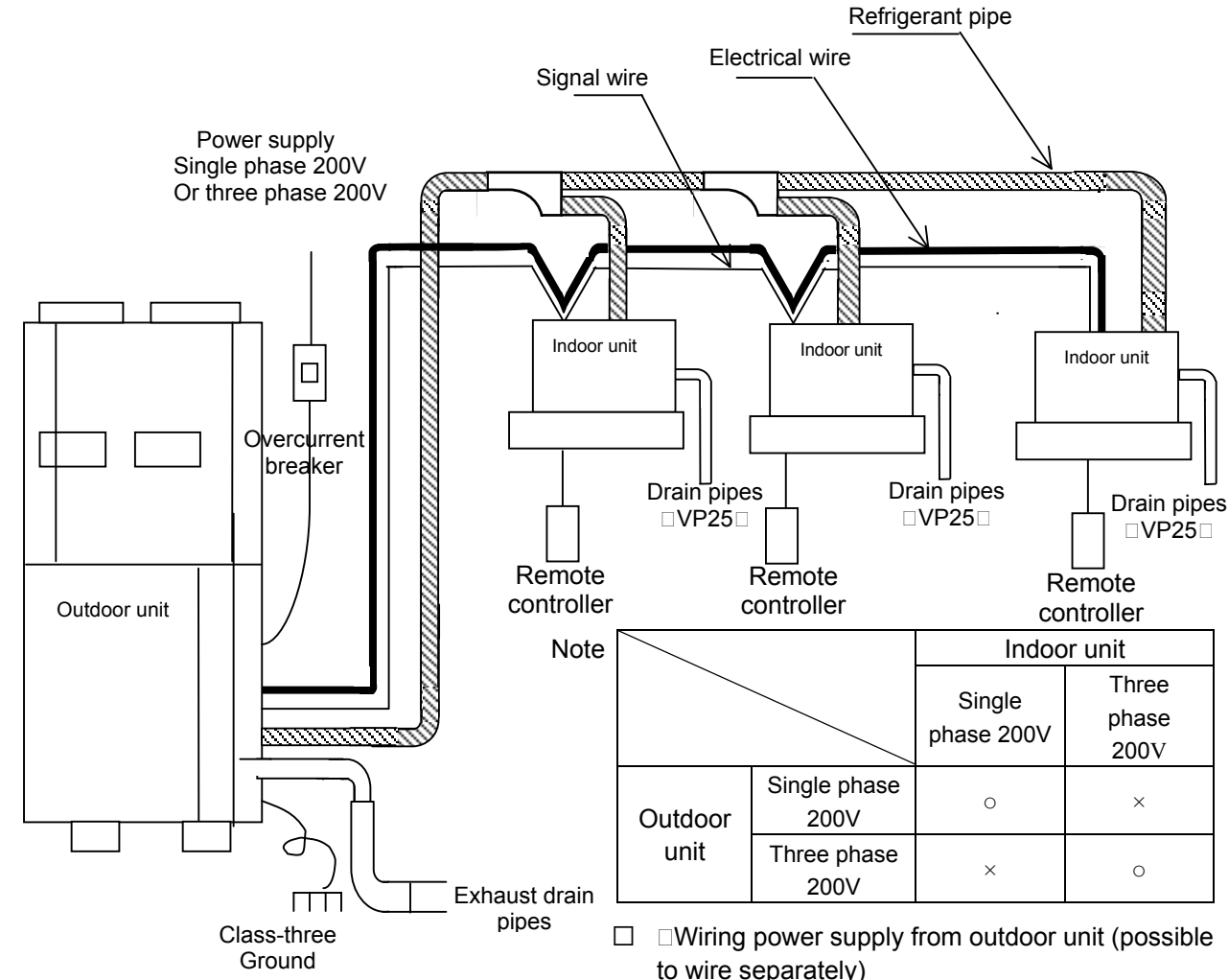
Note:
The capabilities of indoor units slightly decrease during the simultaneous operation of these units in excess of a 100% outdoor unit capacity ratio.

(3) Model P355 outdoor unit (TGMP355***)

Model No. / Type	P22	P28	P36	P45	P56	P71	P80	P90	P112	P140	P160	P224	P280
	2.2 (kW)	2.8 (kW)	3.6 (kW)	4.5 (kW)	5.6 (kW)	7.1 (kW)	8.0 (kW)	9.0 (kW)	11.2 (kW)	14.0 (kW)	16.0 (kW)	22.4 (kW)	28.4 (kW)
4-/3-/2-way cassette type TKT		○	○	○	○	○	○	○	○	○	○		
4-/3-/2-way compact cassette type TKTC		○	○	○	○								
2-way cassette type TKTW	○	○	○	○	○	○	○	○	○	○	○		
1-way cassette type TKTS		○	○	○	○	○							
Built-in cassette type TKR	○	○	○	○	○	○		○	○	○			
Ceiling-embedded high static-pressure duct type TKU				○	○	○		○	○	○		○	○
Ceiling-embedded medium static-pressure duct type TKUM	○	○	○	○	○	○		○	○	○			
Ceiling-suspended type TKE			○	○	○	○		○	○	○			
Wall-mounted type TKK		○	○	○		○							
Floor-standing lowboy (exposed) TKFL		○		○	○	○							
Floor-standing lowboy (concealed) TKFU		○		○	○	○							
Outside-air processing unit with a direct expansion coil unit TKSA		○		○	○								
Air feed processing unit TKUS								○		○			
Ceiling-suspended oil-resisting type TKES							○			○			
Floor-standing plenum type TKFP										○		○	○
Floor-standing duct type TKFD												○	○
Floor-standing type TKF							○			○			
Capacity available	Outdoor unit capacity ratio: Approx. 50 to 130% (Total capacity of indoor units: P178 to P462)												
Number of connectable indoor units	1 to 12 units												

Note:
The capabilities of indoor units slightly decrease during the simultaneous operation of these units in excess of a 100% outdoor unit capacity ratio.

1.2.3 Structure drawing

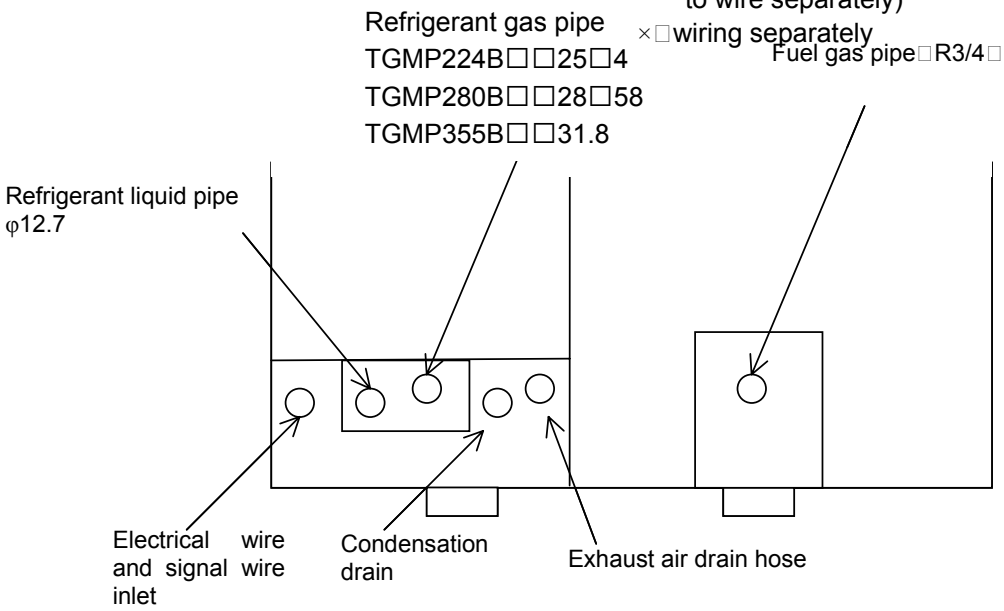


Note

		Indoor unit	
		Single phase 200V	Three phase 200V
Outdoor unit	Single phase 200V	○	×
	Three phase 200V	×	○

□ □Wiring power supply from outdoor unit (possible to wire separately)

×□wiring separately



Connecting position for piping wiring (Rear side of outdoor unit)

1.2.4 Outdoor unit Specification

City gas 13A (12A) specifications (50/60HZ)

Model No.				TGMP224B2N
Type				P224 Multi for building
Capability	Cooling rating		kW	22.4
	Heating rating			26.5
Operating Sound			dB	Normal 53, Silent Mode 51
Outer dimensions	Height		□	1866
	Width			1398
	Depth			798
Mass			□	530
Exterior color (DIC)				3.6GY 8.0/0.9 DIC546 1/2
Electricity characteristics	Power source		V	Single phase 200 / Three phase 200
	Starting current		A	20
	Running current (A)		Cooling	3.9/4.7, 2.3/2.7
			Heating	4.0/4.7, 2.3/2.7
	Power consumption (kw)		Cooling	0.74/0.90
			Heating	0.76/0.92
	Power ratio(%)		Cooling	95/96, 93/96
			Heating	95/98, 95/98
Fuel	Consumption	Cooling	kW	18.6
		Heating		17.5
Engine	Type			Water-cooled vertical type, 4-cycle, 3-cylinder OHV
	Exhaust volume		L	0.952
	Rated output		kW	7.5
	Revolution range		min^{-1}	(Cooling) 1200 to 1650
				(Heating) 1200 to 2050
	Lubricating oil	Type		Aisin GHP Oil L10000
		Capacity	L	35
	Exhaust port position			Upper side
Engine coolant	Type			Aisin Coolant S
	Sealing amount		L	14
	Concentration		%	65
	Freezing temperature		°C	-35
	Pump	Type		Magnet type spiral pump
		Motor output	W	105/150

Compressor	Type × Number of units			Scroll type×2
	Exclusion capacity		L/rev	0.0605X2
	Revolution range		min^{-1}	(cooling) 2280 to 3085
			min^{-1}	(heating) 2280 to 3895
	Specified refrigerator oil			NL10
	Refrigerator oil enclosure q'ty		L	4
	Power transfer method			Poly V-belting
Refrig-erant	Type			R407C
	Sealing amount		□	13
Heat exchanger	Outdoor unit heat exchanger			Slit fin
	Exhaust gas heat exchanger			Multi-pipe heat exchanger
	Engine radiator			Louver fin
Air suction port				Front and rear side
Air blowing port				Upper
Exhaust heat absorption				Heating refrigerant in double pipe
Fan	Type × Number of units			Propeller fan ×2
	Rated air amount		m^3/min	210
	Motor	Type		Single-phase induction motor (8P)
		Rated output	W	180X2
Pipe dimensions	Refrigerant piping	Liquid pipe	mm	φ12.7 flare connection
		Gas pipe		φ25.4 flange connection
	Fuel gas pipe			R 3/4
	Exhaust drain pipe		mm	φ15
Permissible pipe length			m	125 (Equivalent length)
				100 (Actual length)
Permissible difference in elevation between indoor/outdoor unit				50(Outdoor unit at top)
				40(Outdoor unit at bottom)
Permissible difference in elevation between indoor units				15
Connectable indoor units			number	1 to 12
			capacity	P22 to P224
Legal freezing capacity			RT	2.3

Notes:

1. The cooling/heating capability and electrical characteristics data shown in the above table was measured under the conditions of JIS B 8627.
2. The operating sound level shown in the above table was measured in an anechoic room, subject to the relevant provisions of JIS. Under actual conditions, the operating sound level shown above is usually exceeded since it is affected by ambient noise and the echoes of the installation room.

Propane gas specifications (50/60HZ)

Model No.				TGMP224B2P
Type				P224 Multi for building
Capability	Cooling rating		kW	22.4
	Heating rating			26.5
Operating Sound			dB	Normal 53, Silent Mode 51
Outer dimensions	Height		□	1866
	Width			1398
	Depth			798
Mass			□	530
Exterior color (DIC)				3.6GY 8.0/0.9 DIC546 1/2
Electricity characteristics	Power source		V	Single phase 200 / Three phase 200
	Starting current		A	20
	Running current (A)		Cooling	3.9/4.7, 2.3/2.7
			Heating	4.0/4.7, 2.3/2.7
	Power consumption (kw)		Cooling	0.74/0.90
			Heating	0.76/0.92
	Power ratio(%)		Cooling	95/96, 93/96
			Heating	95/98, 95/98
Fuel	Consumption	Cooling	kW	18.6
		Heating		17.5
Engine	Type			Water-cooled vertical type, 4-cycle, 3-cylinder OHV
	Exhaust volume		L	0.952
	Rated output		kW	6.0
	Revolution range		min^{-1}	(Cooling) 1200 to 1600
				(Heating) 1200 to 2050
	Lubricating oil	Type		Aisin GHP Oil L10000
		Capacity	L	35
	Exhaust port position			Upper side
Engine coolant	Type			Aisin Coolant S
	Sealing amount		L	14
	Concentration		%	65
	Freezing temperature		°C	-35
	Pump	Type		Magnet type spiral pump
		Motor output	W	105/150

Compressor	Type × Number of units			Scroll type×2
	Exclusion capacity		L/rev	0.0605X2
	Revolution range		min^{-1}	(cooling) 2280 to 3040
			min^{-1}	(heating) 2280 to 3895
	Specified refrigerator oil			NL10
	Refrigerator oil enclosure q'ty		L	4
	Power transfer method			Poly V-belting
Refrigerant	Type			R407C
	Sealing amount		□	13
Heat exchanger	Outdoor unit heat exchanger			Slit fin
	Exhaust gas heat exchanger			Multi-pipe heat exchanger
	Engine radiator			Louver fin
Air suction port				Front and rear side
Air blowing port				Upper
Exhaust heat absorption				Heating refrigerant in double pipe
Fan	Type × Number of units			Propeller fan ×2
	Rated air amount		m^3/min	180
	Motor	Type		Single-phase induction motor (8P)
		Rated output	W	180X2
Pipe dimensions	Refrigerant piping	Liquid pipe	mm	φ12.7 flare connection
		Gas pipe		φ25.4 flange connection
	Fuel gas pipe			R 3/4
	Exhaust drain pipe		mm	φ15
	Permissible pipe length		m	125 (Equivalent length)
				100 (Actual length)
	Permissible difference in elevation between indoor/outdoor unit			50(Outdoor unit at top)
				40(Outdoor unit at bottom)
	Permissible difference in elevation between indoor units			15
	Connectable indoor units		number	1 to 12
			capacity	P22 to P224
	Legal freezing capacity		RT	2.3

Notes:

1. The cooling/heating capability and electrical characteristics data shown in the above table was measured under the conditions of JIS B 8627.
2. The operating sound level shown in the above table was measured in an anechoic room, subject to the relevant provisions of JIS. Under actual conditions, the operating sound level shown above is usually exceeded since it is affected by ambient noise and the echoes of the installation room.

City gas 13A (12A) specifications (50/60HZ)

Model No.				TGMP280B2N
Type				P280 Multi for building
Capability	Cooling rating	kW		28.0
	Heating rating			33.5
Operating Sound		dB		Normal 57, Silent Mode 55
Outer dimensions	Height	□		2118
	Width			1398
	Depth			798
Mass		□		560
Exterior color (DIC)				3.6GY 8.0/0.9 DIC546 1/2
Electricity characteristics	Power source	V		Single phase 200 / Three phase 200
	Starting current	A		20
	Running current (A)	Cooling		5.0/5.9, 2.9/3.4
		Heating		5.3/6.1, 3.1/3.5
	Power consumption (kw)	Cooling		0.96/1.15
		Heating		1.01/1.19
	Power ratio(%)	Cooling		96/97, 96/98
		Heating		95/98, 94/98
Fuel	Consumption	Cooling	kW	24.5
		Heating		22.4
Engine	Type			Water-cooled vertical type, 4-cycle, 3-cylinder OHV
	Exhaust volume	L		0.952
	Rated output	kW		7.5
	Revolution range	min^{-1}		(Cooling) 1200 to 2150
				(Heating) 1200 to 2550
	Lubricating oil	Type		Aisin GHP Oil L10000
		Capacity	L	35
	Exhaust port position			Upper side
Engine coolant	Type			Aisin Coolant S
	Sealing amount	L		15.5
	Concentration	%		65
	Freezing temperature	°C		-35
	Pump	Type		Magnet type spiral pump
		Motor output	W	105/150

Compressor	Type × Number of units			Scroll type×2
	Exclusion capacity	L/rev		0.0605X2
	Revolution range	min^{-1}		(cooling) 2280 to 4085
		min^{-1}		(heating) 2280 to 4845
	Specified refrigerator oil			NL10
	Refrigerator oil enclosure q'ty		L	4
	Power transfer method			Poly V-belting
Refrigerant	Type			R407C
	Sealing amount	□		13
Heat exchanger	Outdoor unit heat exchanger			Slit fin
	Exhaust gas heat exchanger			Multi-pipe heat exchanger
	Engine radiator			Louver fin
Air suction port				Front and rear side
Air blowing port				Upper
Exhaust heat absorption				Heating refrigerant in double pipe
Fan	Type × Number of units			Propeller fan ×2
	Rated air amount	m^3/min		210
	Motor	Type		Single-phase induction motor (8P)
		Rated output	W	220X2
Pipe dimensions	Refrigerant piping	Liquid pipe	mm	φ12.7 flare connection
		Gas pipe		φ28.58 flange connection
	Fuel gas pipe			R 3/4
	Exhaust drain pipe		mm	φ15
Permissible pipe length			m	125 (Equivalent length)
				100 (Actual length)
Permissible difference in elevation between indoor/outdoor unit				50(Outdoor unit at top)
				40(Outdoor unit at bottom)
Permissible difference in elevation between indoor units				15
Connectable indoor units			number	1 to 12
			capacity	P22 to P280
Legal freezing capacity			RT	3.0

Notes:

1. The cooling/heating capability and electrical characteristics data shown in the above table was measured under the conditions of JIS B 862.
2. The operating sound level shown in the above table was measured in an anechoic room, subject to the relevant provisions of JIS. Under actual conditions, the operating sound level shown above is usually exceeded since it is affected by ambient noise and the echoes of the installation room.

Propane gas specifications (50/60HZ)

Model No.				TGMP280B2P
Type				P280 Multi for building
Capability	Cooling rating		kW	28.0
	Heating rating			33.5
Operating Sound			dB	Normal 57, Silent Mode 55
Outer dimensions	Height			2118
	Width		□	1398
	Depth			798
Mass			□	560
Exterior color (DIC)				3.6GY 8.0/0.9 DIC546 1/2
Electricity characteristics	Power source		V	Single phase 200 / Three phase 200
	Starting current		A	20
	Running current (A)		Cooling	5.0/5.9, 2.9/3.4
			Heating	5.3/6.1, 3.1/3.5
	Power consumption (kw)		Cooling	0.96/1.15
			Heating	1.01/1.19
	Power ratio(%)		Cooling	96/97, 96/98
			Heating	95/98, 94/98
Fuel	Consumption	Cooling	kW	24.5
		Heating		22.4
Engine	Type			Water-cooled vertical type, 4-cycle, 3-cylinder OHV
	Exhaust volume		L	0.952
	Rated output		kW	7.5
	Revolution range		min^{-1}	(Cooling) 1200 to 2150
				(Heating) 1200 to 2550
	Lubricating oil	Type		Aisin GHP Oil L10000
		Capacity	L	35
	Exhaust port position			Upper side
Engine coolant	Type			Aisin Coolant S
	Sealing amount		L	15.5
	Concentration		%	65
	Freezing temperature		°C	-35
	Pump	Type		Magnet type spiral pump
		Motor output	W	105/150

Compressor	Type × Number of units			Scroll type×2
	Exclusion capacity		L/rev	0.0605X2
	Revolution range		min^{-1}	(cooling) 2280 to 4085
			min^{-1}	(heating) 2280 to 4845
	Specified refrigerator oil			NL10
	Refrigerator oil enclosure q'ty		L	4
	Power transfer method			Poly V-belting
Refrigerant	Type			R407C
	Sealing amount		□	13
Heat exchanger	Outdoor unit heat exchanger			Slit fin
	Exhaust gas heat exchanger			Multi-pipe heat exchanger
	Engine radiator			Louver fin
Air suction port				Front and rear side
Air blowing port				Upper
Exhaust heat absorption				Heating refrigerant in double pipe
Fan	Type × Number of units			Propeller fan ×2
	Rated air amount		m^3/min	210
	Motor	Type		Single-phase induction motor (8P)
		Rated output	W	220X2
Pipe dimensions	Refrigerant piping	Liquid pipe	mm	φ12.7 flare connection
		Gas pipe		φ28.58 flange connection
	Fuel gas pipe			R 3/4
	Exhaust drain pipe		mm	φ15
Permissible pipe length			m	125 (Equivalent length)
				100 (Actual length)
Permissible difference in elevation between indoor/outdoor unit				50(Outdoor unit at top)
				40(Outdoor unit at bottom)
Permissible difference in elevation between indoor units				15
Connectable indoor units			number	1 to 12
			capacity	P22 to P280
Legal freezing capacity			RT	3.0

Notes:

1. The cooling/heating capability and electrical characteristics data shown in the above table was measured under the conditions of JIS B 8627.
2. The operating sound level shown in the above table was measured in an anechoic room, subject to the relevant provisions of JIS. Under actual conditions, the operating sound level shown above is usually exceeded since it is affected by ambient noise and the echoes of the installation room.

13A (12A) specifications

Model No.			TGMP355B2N
Type			New Refrigerant Model P355 Building-Use Multi-Unit
Capability	Cooling rating		35.5 kW
	Heating rating		42.5 kW
Operating sound			58 dB (56 dB in silent mode)
Outer dimensions	Height		2118 mm
	Width		1398 mm
	Depth		798 mm
Mass			560 kg
Exterior color [Munsell]			3.6GY8.0/9.0 or equivalent DIC546 1/2
Electrical characteristics	Power source		200 V single-phase
	Starting current		20 A
	Running current		5.0/5.9, 2.9/3.4 A (Cooling) 5.3/6.1, 3.1/3.5 A (Heating)
	Power consumption		0.961.15 kW (Cooling) 1.10/1.19 kW (Heating)
	Power ratio		96/97, 96/98% (Cooling) 95/98, 94/98% (Heating)
Fuel	Consumption		29.9 kW (Cooling rating) 29.6 kW (Heating rating)
Engine	Type		Water-cooled vertical type, 4-cycle, 3-cylinder OHV
	Exhaust volume		952 cm^3
	Rated output		9.5 kW
	Revolution range		1200 to 2450 min^{-1} (Cooling) 1200 to 2550 min^{-1} (Heating)
	Lubricating oil type		Aisin Gas Engine Oil (L10000)
	Lubricating oil enclosure q'ty		35 L
	Exhaust port position		Top
Coolant	Type		Aisin Coolant S
	Enclosure q'ty		15.5 L
	Concentration		50%
	Freezing temperature		–35°C
	Pump	Type	Magnet type spiral pump
		Motor rated output	0.105/0.150 kW

Compressor	Type × Number of units		Scroll type × 2
	Exclusion capacity		60.5 cm^3/rev × 2
	Revolution range		2280 to 4655 min^{-1} (Cooling) 2280 to 4845 min^{-1} (Heating)
	Specified refrigerator oil		NL10
	Refrigerator oil enclosure q'ty		4 L
	Power transfer method		Poly V-belting
Refrigerant	Type		R407C
	Enclosure q'ty		13 kg
Heat exchanger	Outdoor unit heat exchanger		Slit fin
	Exhaust gas heat exchanger		Multi-pipe heat exchanger
	Engine radiator		Louver fin
Air suction port			Front and rear
Air blowing port			Top
Exhaust heat collection method			Refrigerant heating
Fan	Type × Number of units		Propeller fan × 2
	Rated air amount		210 m^3/min
	Motor	Type	Single-phase induction motor (6P)
		Rated output	0.22 kW
Pipe dimensions	Refrigerant piping	Liquid pipe	ϕ12.7 mm Flare-connected
		Gas pipe	ϕ31.8 mm Flange-mounted
	Fuel gas pipe		R3/4
	Exhaust drain pipe		ϕ15 mm
Permissible pipe length			125 m (Equivalent length)
			100 m (Actual length)
Permissible difference in elevation between indoor/outdoor units			50 m (Outdoor unit upper)
			40 m (Outdoor unit lower)
Permissible difference in elevation between indoor units			15 m
Number of indoor units which can be combined			1 to 12 units (Capacity: P22 to P280)
Legal freezing capacity			3.4 RT
			(50/60 Hz)

Notes:

1. The cooling/heating capability and electrical characteristics data shown in the above table was measured under the conditions of JIS B 8627.
2. The operating sound level shown in the above table was measured in an anechoic room, subject to the relevant provisions of JIS. Under actual conditions, the operating sound level shown above is usually exceeded since it is affected by ambient noise and the echoes of the installation room.

Class-A propane gas specifications

Model No.			TGMP355B2P
Type			New Refrigerant Model P355 Building-Use Multi-Unit
Capability	Cooling rating		35.5 kW
	Heating rating		42.5 kW
Operating sound			58 dB (56 dB in silent mode)
Outer dimensions	Height		2118 mm
	Width		1398 mm
	Depth		798 mm
Mass			560 kg
Exterior color [Munsell]			3.6GY8.0/9.0 or equivalent DIC546 1/2
Electrical characteristics	Power source		200 V single-phase
	Starting current		20 A
	Running current		5.0/5.9, 2.9/3.4 A (Cooling) 5.3/6.1, 3.1/3.5 A (Heating)
	Power consumption		0.95/1.15 kW (Cooling) 1.10/1.19 kW (Heating)
	Power ratio		96/97, 96/98% (Cooling) 95/98, 94/98% (Heating)
Fuel	Consumption		29.9 kW (Cooling rating) 29.6 kW (Heating rating)
Engine	Type		Water-cooled vertical type, 4-cycle, 3-cylinder OHV
	Exhaust volume		952 cm^3
	Rated output		9.5 kW
	Revolution range		1200 to 2450 min^{-1} (Cooling) 1200 to 2550 min^{-1} (Heating)
	Lubricating oil type		Aisin Gas Engine Oil (L10000)
	Lubricating oil enclosure q'ty		35 L
	Exhaust port position		Top
Coolant	Type		Aisin Coolant S
	Enclosure q'ty		15.5 L
	Concentration		50%
	Freezing temperature		–35°C
	Pump	Type	Magnet type spiral pump
		Motor rated output	0.105/0.150 kW

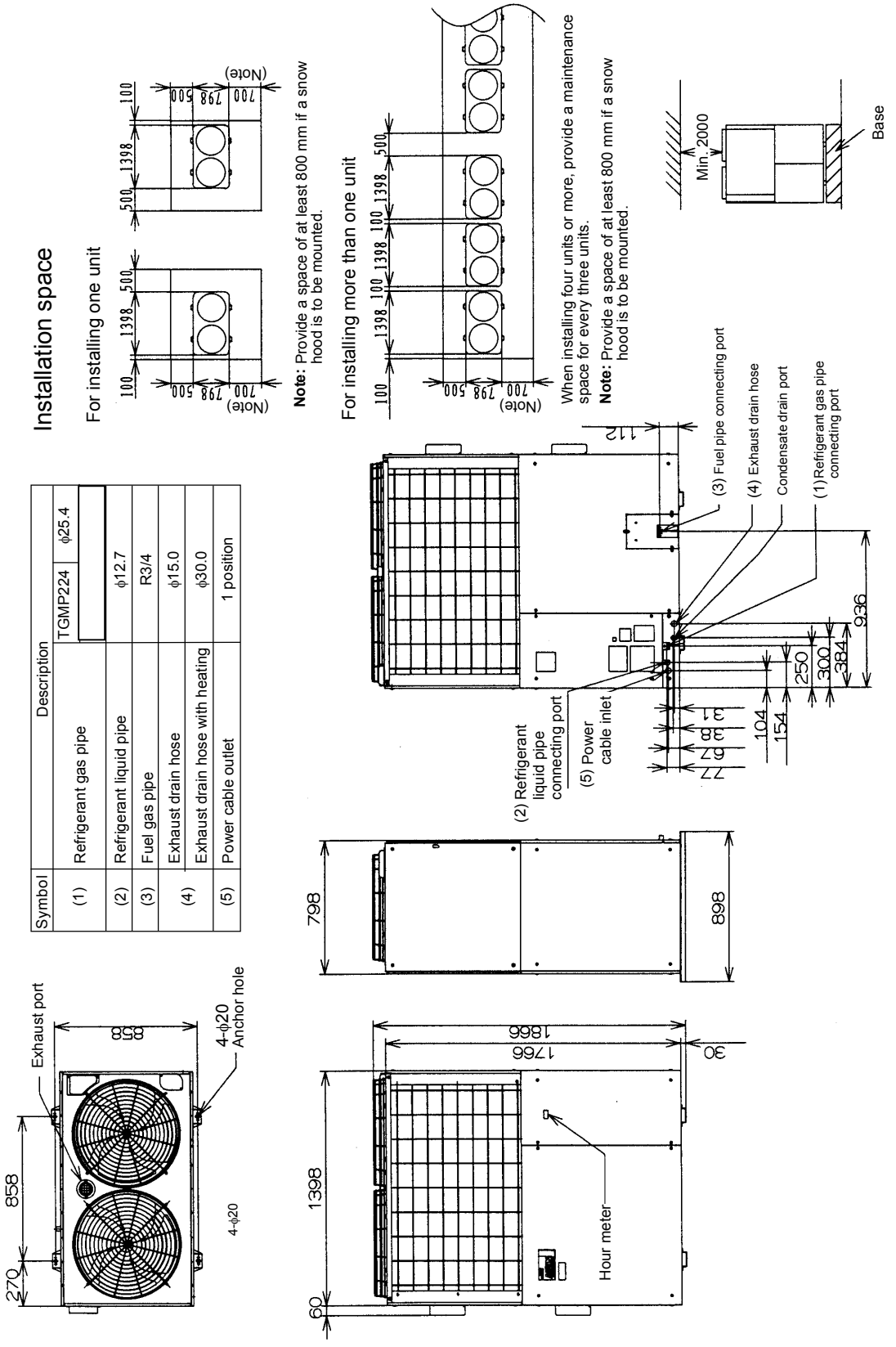
Compressor	Type × Number of units		Scroll type × 2
	Exclusion capacity		60.5 cm^3/rev × 2
	Revolution range		2280 to 4655 min^{-1} (Cooling) 2280 to 4845 min^{-1} (Heating)
	Specified refrigerator oil		NL10
	Refrigerator oil enclosure q'ty		4 L
	Power transfer method		Poly V-belting
Refrigerant	Type		R407C
	Enclosure q'ty		13 kg
Heat exchanger	Outdoor unit heat exchanger		Slit fin
	Exhaust gas heat exchanger		Multi-pipe heat exchanger
	Engine radiator		Louver fin
Air suction port			Front and rear
Air blowing port			Top
Exhaust heat collection method			Refrigerant heating
Fan	Type × Number of units		Propeller fan × 2
	Rated air amount		210 m^3/min
	Motor	Type	Single-phase induction motor (6P)
		Rated output	0.22 kW
Pipe dimensions	Refrigerant piping	Liquid pipe	ϕ12.7 mm Flare-connected
		Gas pipe	ϕ31.8 mm Flange-mounted
	Fuel gas pipe		R3/4
	Exhaust drain pipe		ϕ15 mm
Permissible pipe length			125 m (Equivalent length)
			100 m (Actual length)
Permissible difference in elevation between indoor/outdoor units			50 m (Outdoor unit upper)
			40 m (Outdoor unit lower)
Permissible difference in elevation between indoor units			15 m
Number of indoor units which can be combined			1 to 12 units (Capacity: P22 to P280)
Legal freezing capacity			3.4 RT
			(50/60 Hz)

Notes:

1. The cooling/heating capability and electrical characteristics data shown in the above table was measured under the conditions of JIS B 8627.
2. The operating sound level shown in the above table was measured in an anechoic room, subject to the relevant provisions of JIS. Under actual conditions, the operating sound level shown above is usually exceeded since it is affected by ambient noise and the echoes of the installation room.

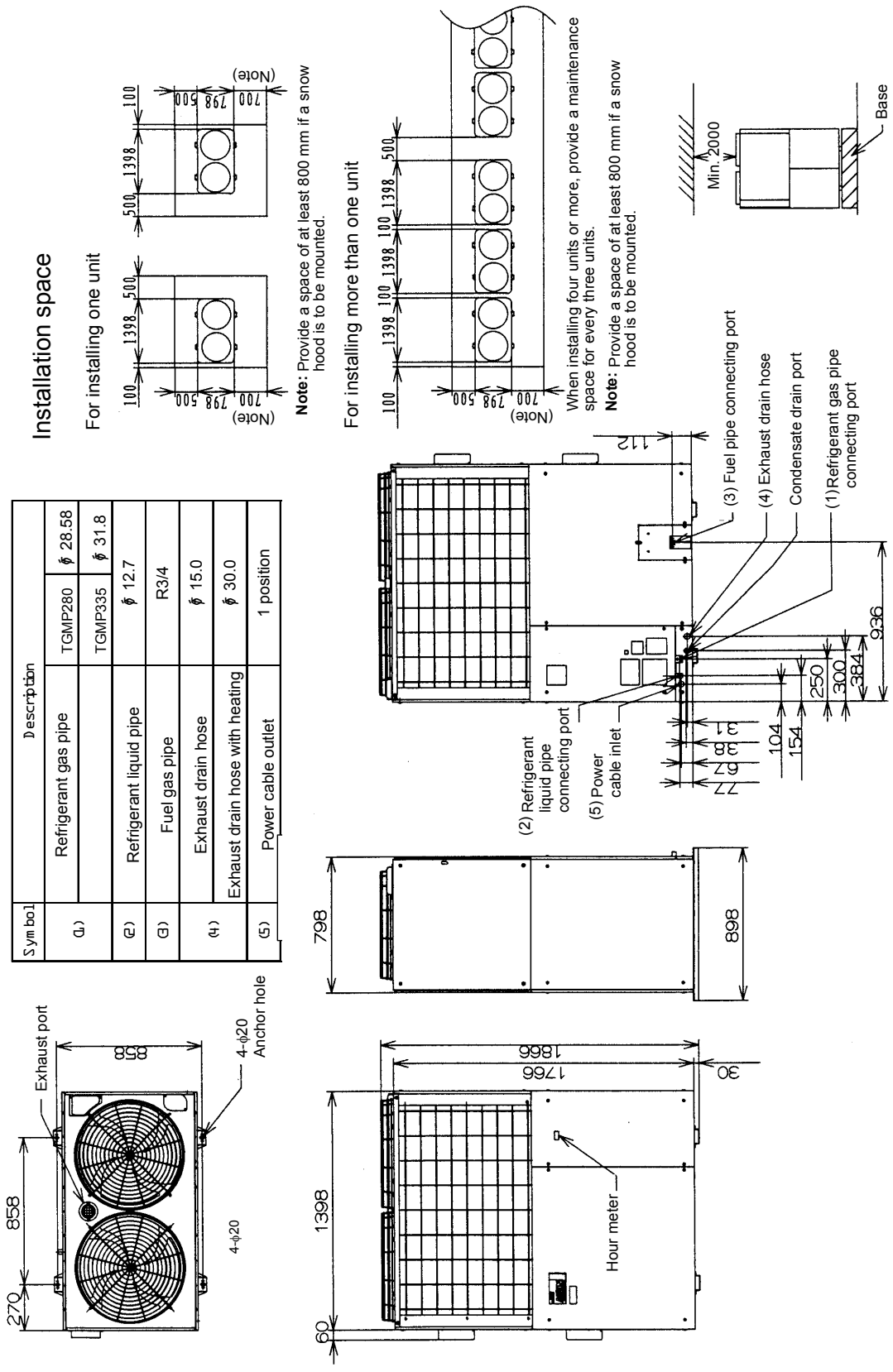
1.3 Outside Drawing of Outdoor Unit

(1) TGMP224B

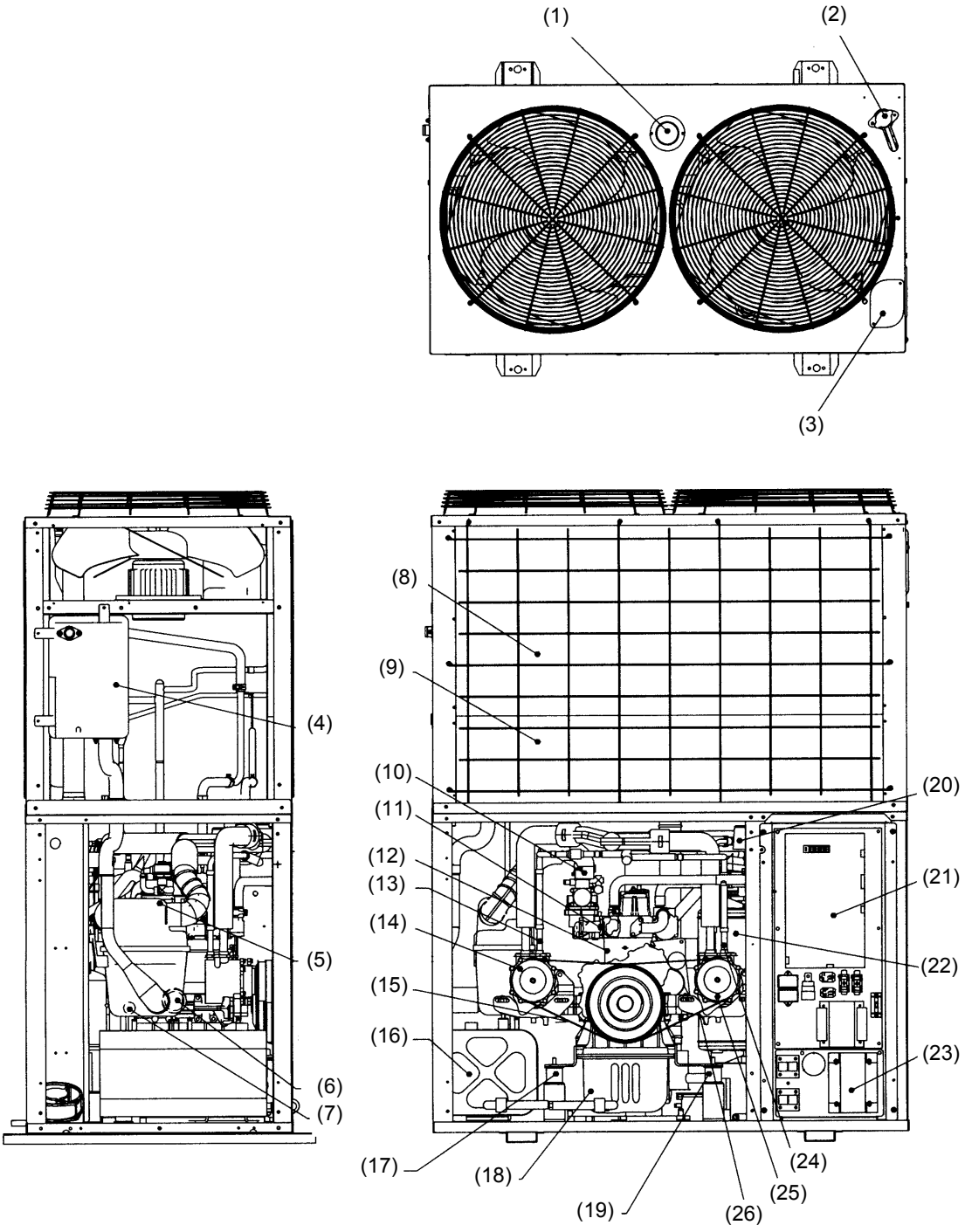


Symbol	Description	TGMP224
(1)	Refrigerant gas pipe	φ25.4
(2)	Refrigerant liquid pipe	φ12.7
(3)	Fuel gas pipe	R3/4
(4)	Exhaust drain hose	φ15.0
	Exhaust drain hose with heating	φ30.0
(5)	Power cable outlet	1 position

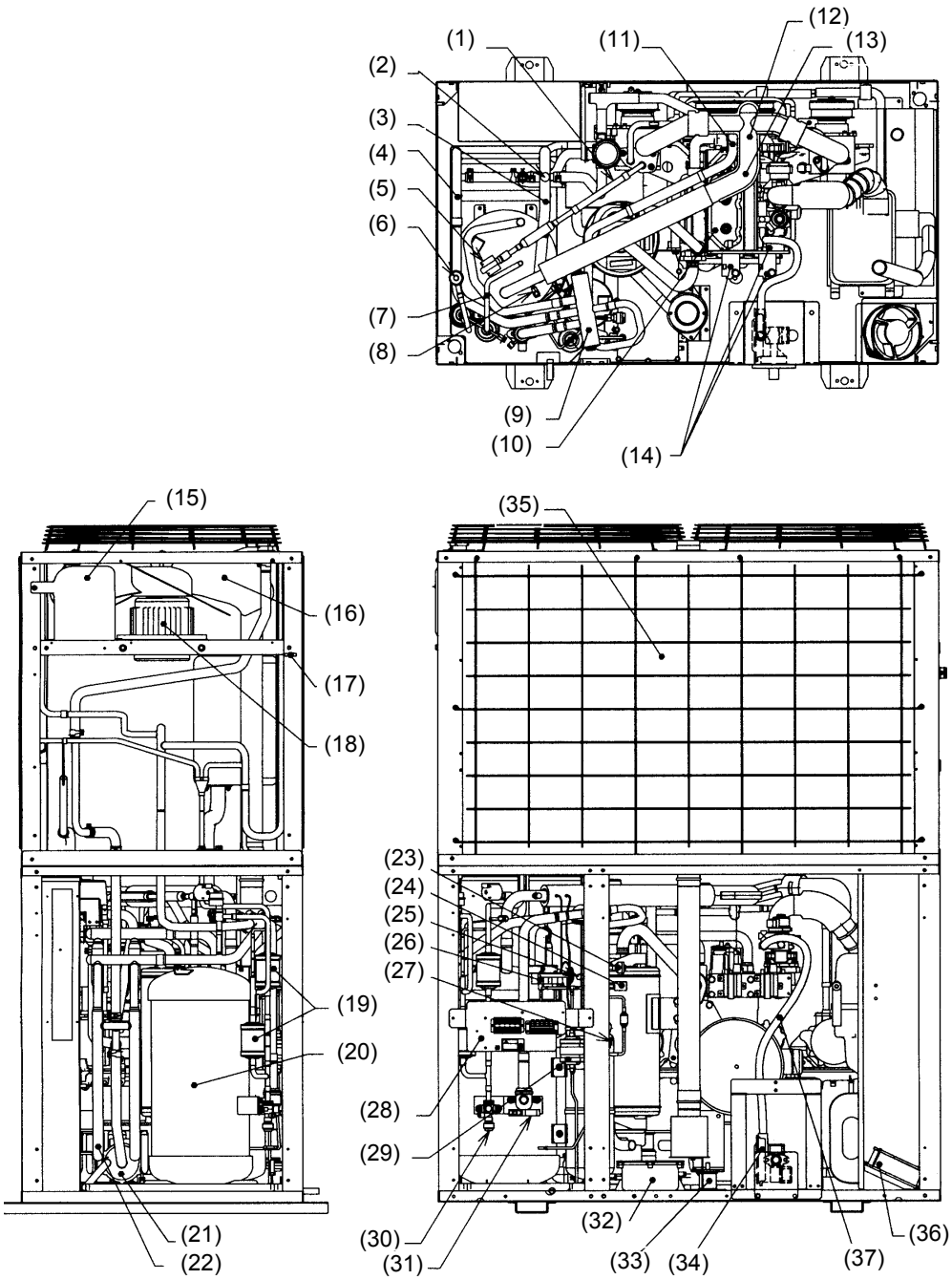
(2) TGMP280/355B



1.5 Outdoor Unit Internal Structure



(1) Exhaust port
(2) Radiator cap
(3) Reserve tank filling port
(4) Intake air silencer
(5) Air cleaner
(6) Oil filter
(7) Engine oil pressure switch
(8) Outdoor unit heat exchanger
(9) Radiator
(10) Gas mixer
(11) Coolant temperature sensor
(12) Engine
(13) Discharge temperature sensor (L)
(14) Compressor (L)
(15) Compressor belt (L)
(16) Oil subtank
(17) Engine anti-vibration rubber (L)
(18) Oil pan
(19) Engine anti-vibration rubber (R)
(20) Electric three-way valve
(21) Control circuit board
(22) Exhaust heat exchanger
(23) Power supply unit
(24) Discharge temperature sensor (R)
(25) Compressor (R)
(26) Compressor belt (R)



(1) Discharge flexible tube (for capacity control)
(2) Low-pressure switch
(3) Accumulator inlet temperture sensor
(4) Gas pipe temperature sensor
(5) Capacity regulating valve
(6) Liquid flow regulating valve
(7) Heat exchanger liquid temperature sensor
(8) Low-pressure service port
(9) Four-way changeover valve
(10) Engine room temperature sensor (mounted on the top plate)
(11) Discharge flexible tube
(12) Intake flexible tube
(13) Intake temperature sensor
(14) Ignition coil
(15) Reserve tank
(16) Outdoor fan
(17) Outside air temperature sensor
(18) Fan motor
(19) Filter drier
(20) Accumulator
(21) Coolant pump
(22) Double-pipe heat exchanger
(23) High-pressure sensor
(24) High-pressure switch
(25) High-pressure service port
(26) Oil-operated solenoid valve
(27) Hot gas bypass valve
(28) Terminal block
(29) Filter drier
(30) Refrigerant liquid pipe connecting port
(31) Refrigerant gas pipe connecting port
(32) Drain filter
(33) Engine anti-vibration rubber (rear)
(34) Gas regulator (with gas electromagnetic valve)
(35) Outdoor unit heat exchanger
(36) Exhaust fan
(37) Fuel gas hose

1.5 Various Characteristics

1.5.1 Cooling and Heating Capabilities and Gas Consumption for Each Indoor Unit Connection Capacities

(1) TGMP224B2

Indoor Unit Connection Capacity		Total Capabilities [kW]		Gas Consumption [kW]	
New JIS Marking	[kW]	Cooling	Heating	Cooling	Heating
291	29.1	23.8	27.2	19.3	16.4
280	28.0	23.7	27.1	19.3	16.6
270	27.0	23.6	27.0	19.1	16.8
260	26.0	23.3	26.9	19.0	16.9
250	25.0	23.1	26.8	18.9	17.0
240	24.0	22.7	26.7	18.8	17.2
230	23.0	22.5	26.6	18.7	17.4
224	22.4	22.4	26.5	18.6	17.5
220	22.0	22.0	26.0	18.3	17.2
210	21.0	21.0	24.9	17.5	16.6
200	20.0	20.0	23.7	16.7	15.9
190	19.0	19.0	22.5	16.0	15.3
180	18.0	18.0	21.3	15.4	14.6
170	17.0	17.0	20.2	15.1	14.0
160	16.0	16.0	19.0	14.9	13.6
150	15.0	15.0	18.0	14.6	13.4
140	14.0	14.0	17.0	14.2	13.3
130	13.0	13.0	15.6	16.5	13.1
120	12.0	12.0	14.3	15.2	12.9
112	11.2	11.2	13.2	14.1	13.8

(2) TGMP280B2

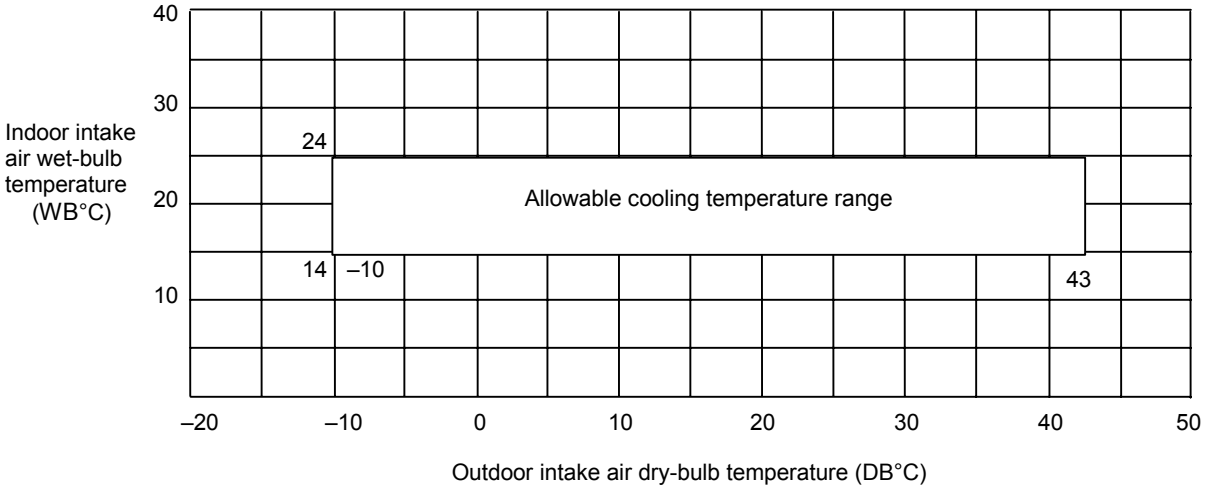
Indoor Unit Connection Capacity		Total Capabilities [kW]		Gas Consumption [kW]	
New JIS Marking	[kW]	Cooling	Heating	Cooling	Heating
364	36.4	29.7	34.6	25.4	21.0
360	36.0	29.6	34.5	25.4	21.1
350	35.0	29.4	34.3	25.3	21.3
340	34.0	29.2	34.2	25.2	21.4
330	33.0	29.0	34.1	25.1	21.6
320	32.0	28.8	34.0	25.0	21.8
310	31.0	28.6	33.9	24.8	21.9
300	30.0	28.4	33.7	24.7	22.0
290	29.0	28.2	33.6	24.6	22.2
280	28.0	28.0	33.5	24.5	22.4
270	27.0	27.0	32.3	23.7	21.6
260	26.0	26.0	31.0	22.9	20.7
250	25.0	25.0	29.8	22.1	19.8
240	24.0	24.0	28.5	21.3	19.0
230	23.0	23.0	27.3	20.5	18.1
224	22.4	22.4	26.5	19.2	17.1
220	22.0	22.0	26.0	18.4	16.5
210	21.0	21.0	24.9	17.6	15.8
200	20.0	20.0	23.7	16.8	15.2
190	19.0	19.0	22.5	16.2	14.5
180	18.0	18.0	21.3	15.9	13.9
170	17.0	17.0	20.2	15.6	13.5
160	16.0	16.0	19.0	15.3	13.3
150	15.0	15.0	18.0	15.0	13.2
140	14.0	14.0	17.0	25.4	21.0

(3) TGMP355B2

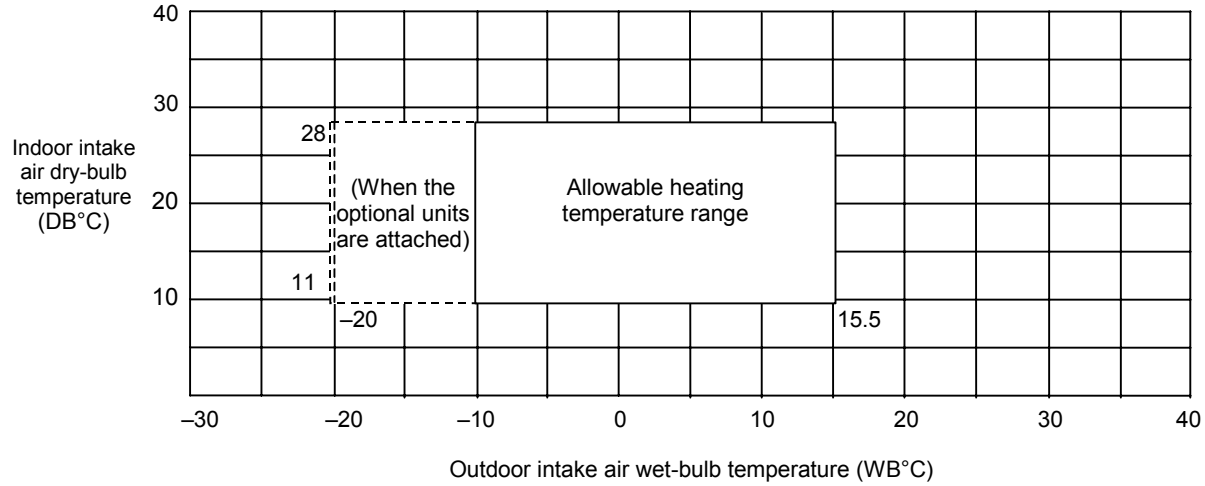
Indoor Unit Connection Capacity		Total Capabilities [kW]		Gas Consumption [kW]	
New JIS Marking	[kW]	Cooling	Heating	Cooling	Heating
461.5	46.15	37.8	43.9	31.1	27.8
450	45.0	37.6	43.7	31.0	28.0
440	44.0	37.5	43.6	30.8	28.2
430	43.0	37.4	43.5	30.7	28.4
420	42.0	37.1	43.3	30.6	28.5
410	41.0	36.8	43.2	30.5	28.6
400	40.0	36.6	43.1	30.4	28.8
390	39.0	36.3	43.0	30.3	29.0
380	38.0	36.1	42.9	30.2	29.2
370	37.0	35.8	42.7	30.1	29.3
360	36.0	35.6	42.6	30.0	29.5
355	35.5	35.5	42.5	29.9	29.6
340	34.0	34.0	40.6	28.4	28.3
330	33.0	33.0	39.3	27.4	27.4
320	32.0	32.0	38.1	26.4	26.5
310	31.0	31.0	36.9	25.4	25.7
300	30.0	30.0	35.8	24.4	24.8
290	29.0	29.0	34.7	23.4	24.0
280	28.0	28.0	33.5	22.4	23.1
270	27.0	27.0	32.3	21.7	22.2
260	26.0	26.0	31.0	21.0	21.4
250	25.0	25.0	29.8	20.2	20.4
240	24.0	24.0	28.5	19.5	19.6
230	23.0	23.0	27.3	18.7	18.7
224	22.4	22.4	26.5	17.9	18.0
220	22.0	22.0	26.0	17.6	17.7
210	21.0	21.0	24.9	16.8	17.0
200	20.0	2.0.	23.7	16.1	16.3
190	19.0	19.0	22.5	15.4	15.7
180	18.0	18.0	21.3	14.8	15.0
170	17.0	17.0	20.2	14.5	14.3
160	16.0	16.0	19.0	14.3	13.9
150	15.0	15.0	18.0	14.0	13.7
140	14.0	14.0	17.0	13.7	13.7

1.5.2 Allowable Cooling and Heating Temperature Ranges

(1) Cooling



(2) Heating

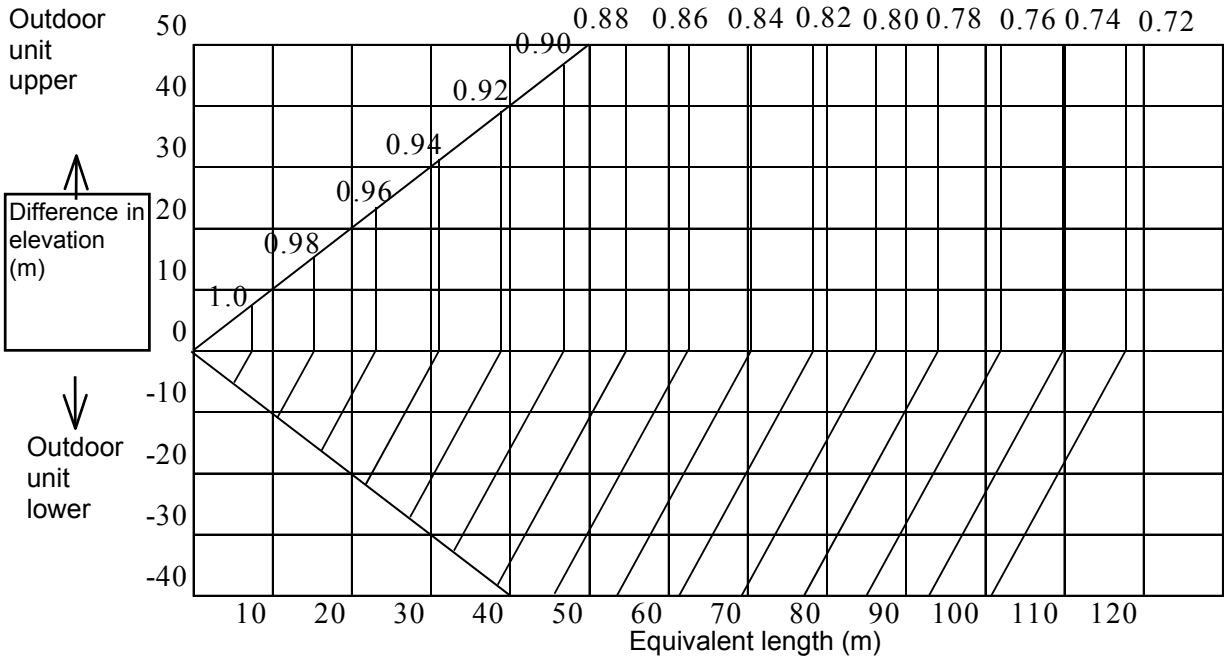


Note:
The temperature setting ranges of the remote control unit are listed in the table below. These temperature ranges slightly differ from the allowable operating temperature ranges of the system.

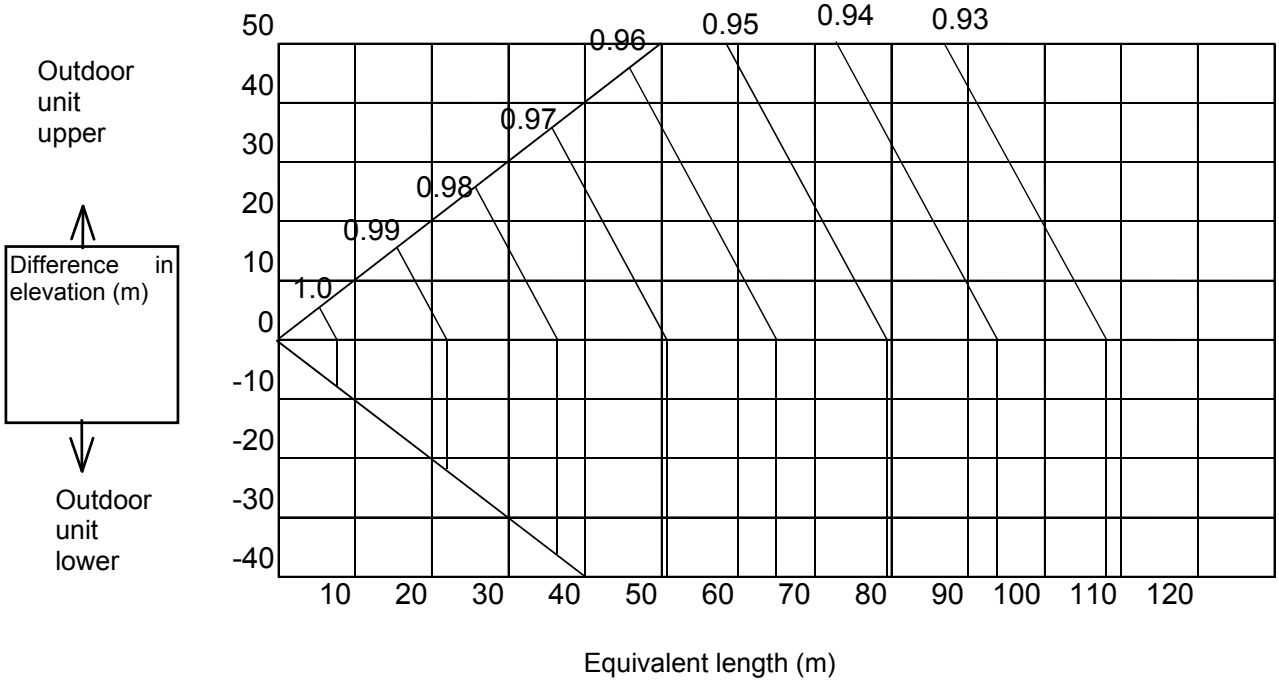
	Maximum	Minimum
Cooling	30	18
Heating	30	18

1.5.3 Changes According to Piping Length

(1) Cooling capacity

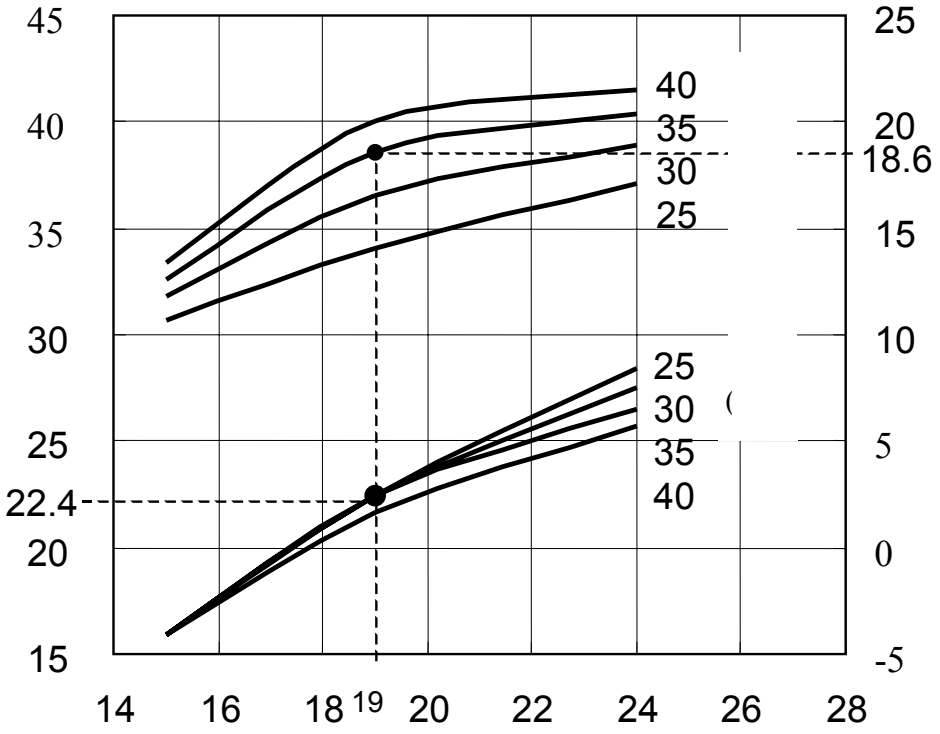


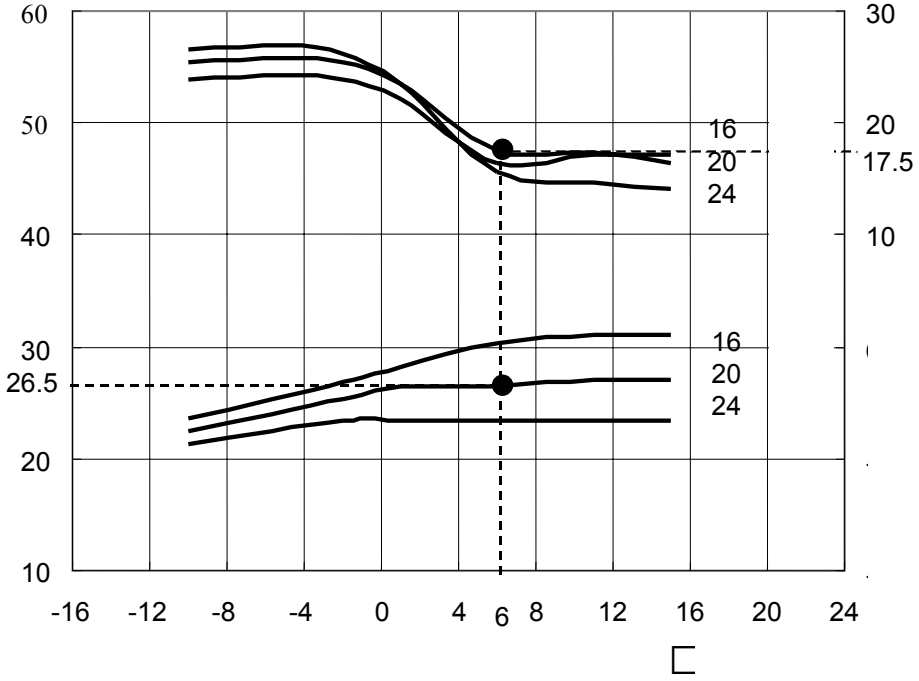
(2) Heating capacity



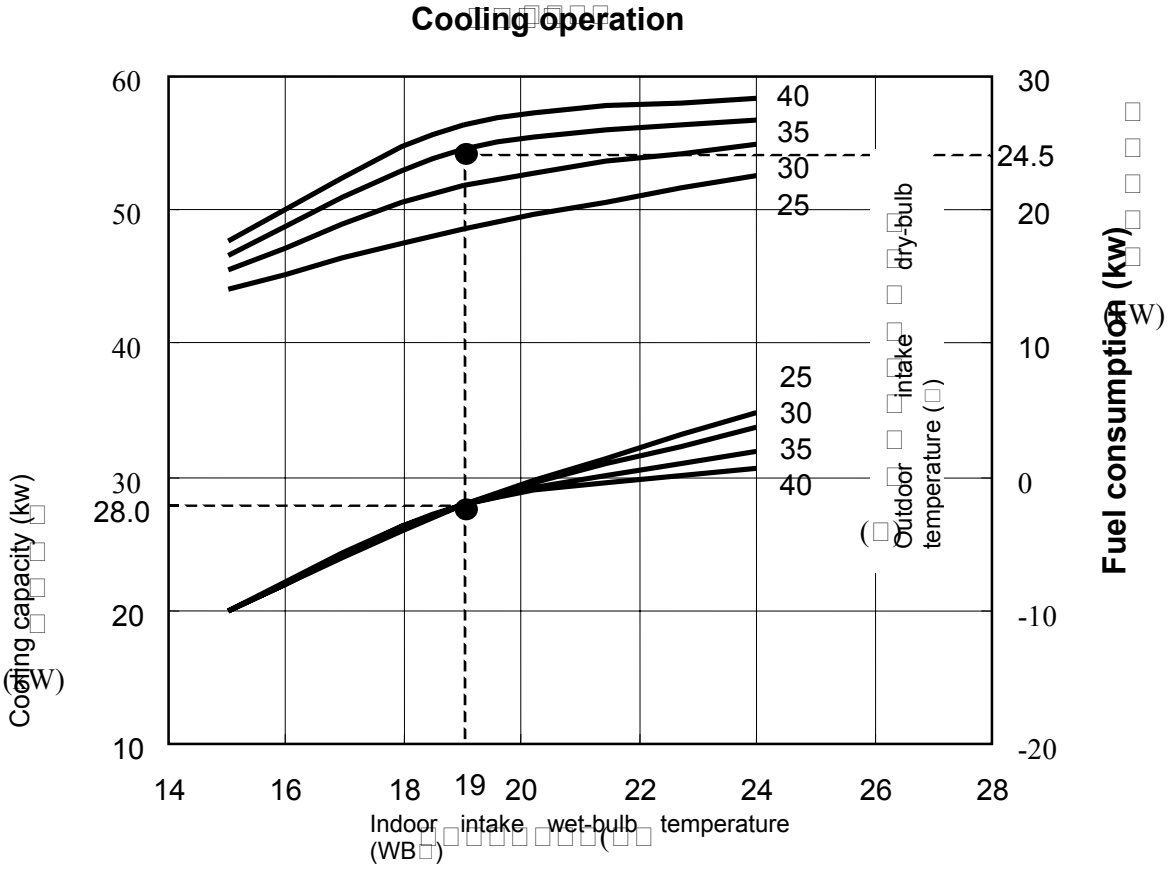
1.5.4 Fuel consumption

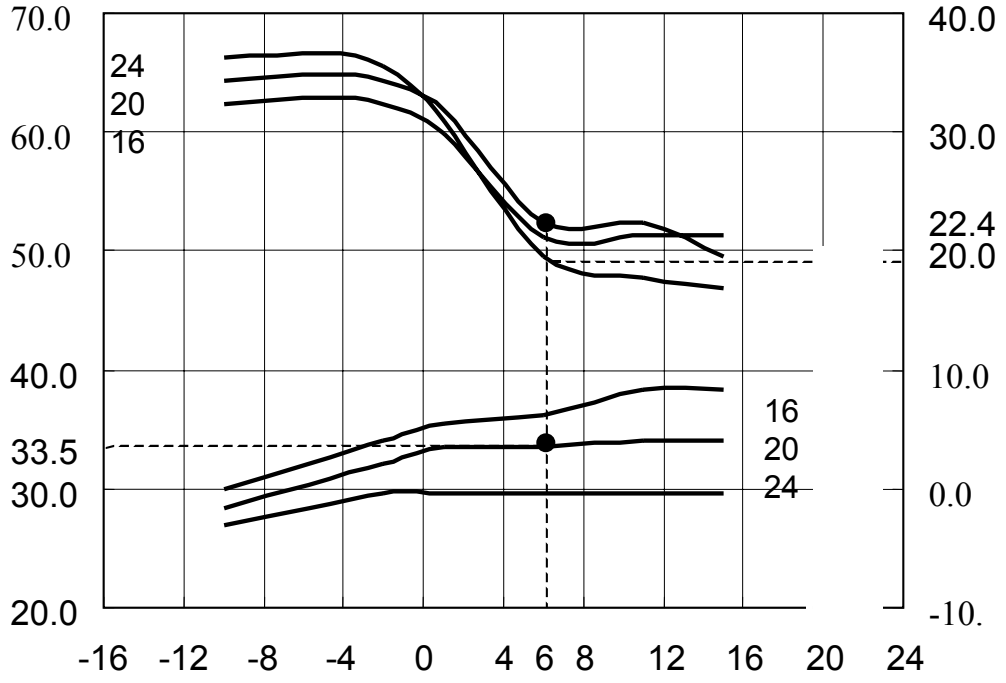
□TGMP224B





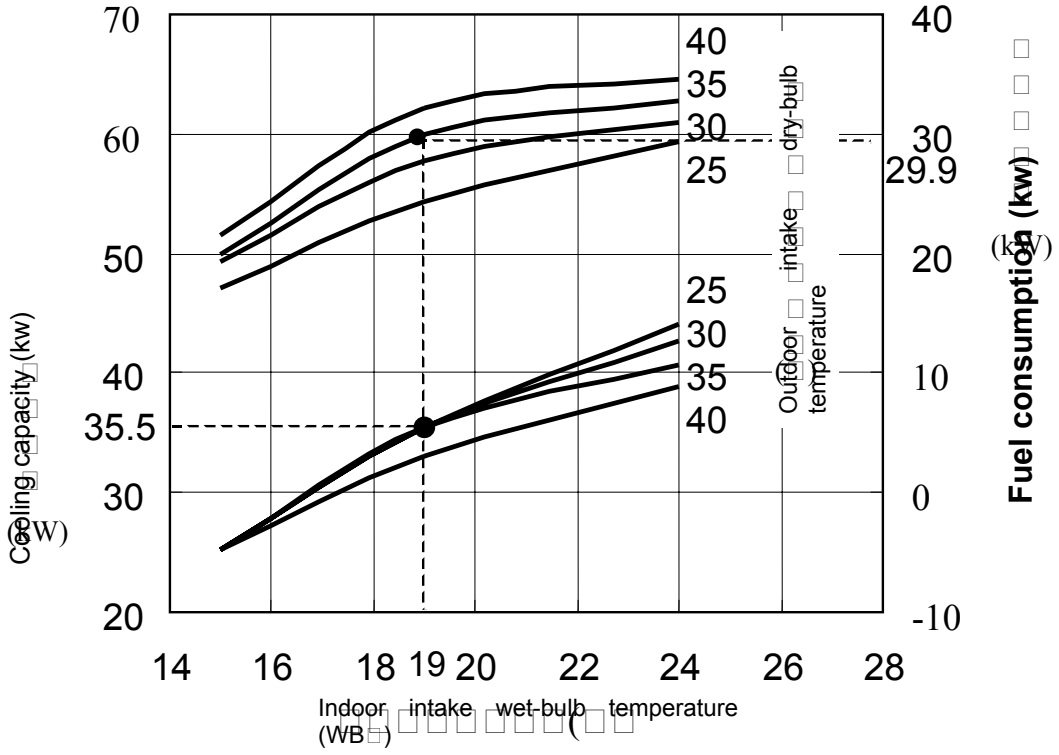
□TGMP□□□B


Cooling operation
60
50
40
30
28.0
20
10
14
16
18
19
20
22
24
26
28
40
35
30
25
25
30
35
40
24.5
30
20
10
0
-10
-20
Cooling capacity (kw)
Fuel consumption (kw)
Outdoor dry-bulb temperature (□)
Indoor intake wet-bulb temperature (WB□)

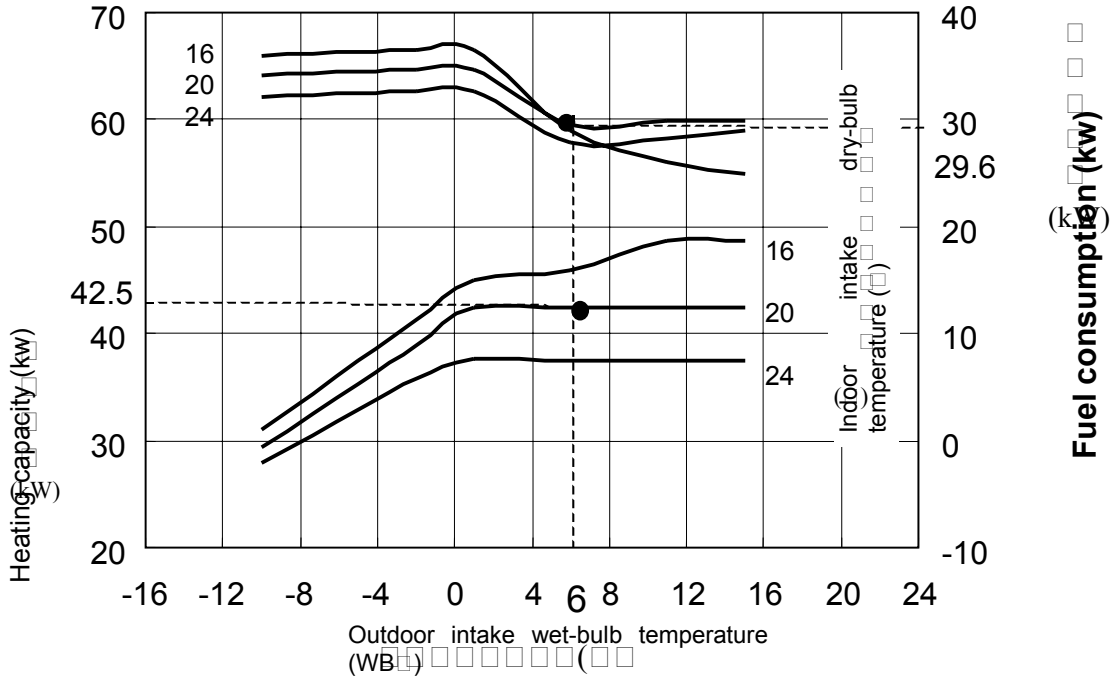

70.0
60.0
50.0
40.0
33.5
30.0
20.0
-16
-12
-8
-4
0
4
6
8
12
16
20
24
24
20
16
16
20
24
40.0
30.0
22.4
20.0
10.0
0.0
-10.

□TGMP□□□B

Cooling operation



Heating operation



1.5.5 Outdoor unit operating sound characteristics

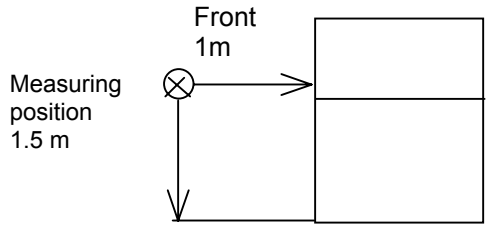
(1)TGMP224B

1. Overall data (dB)

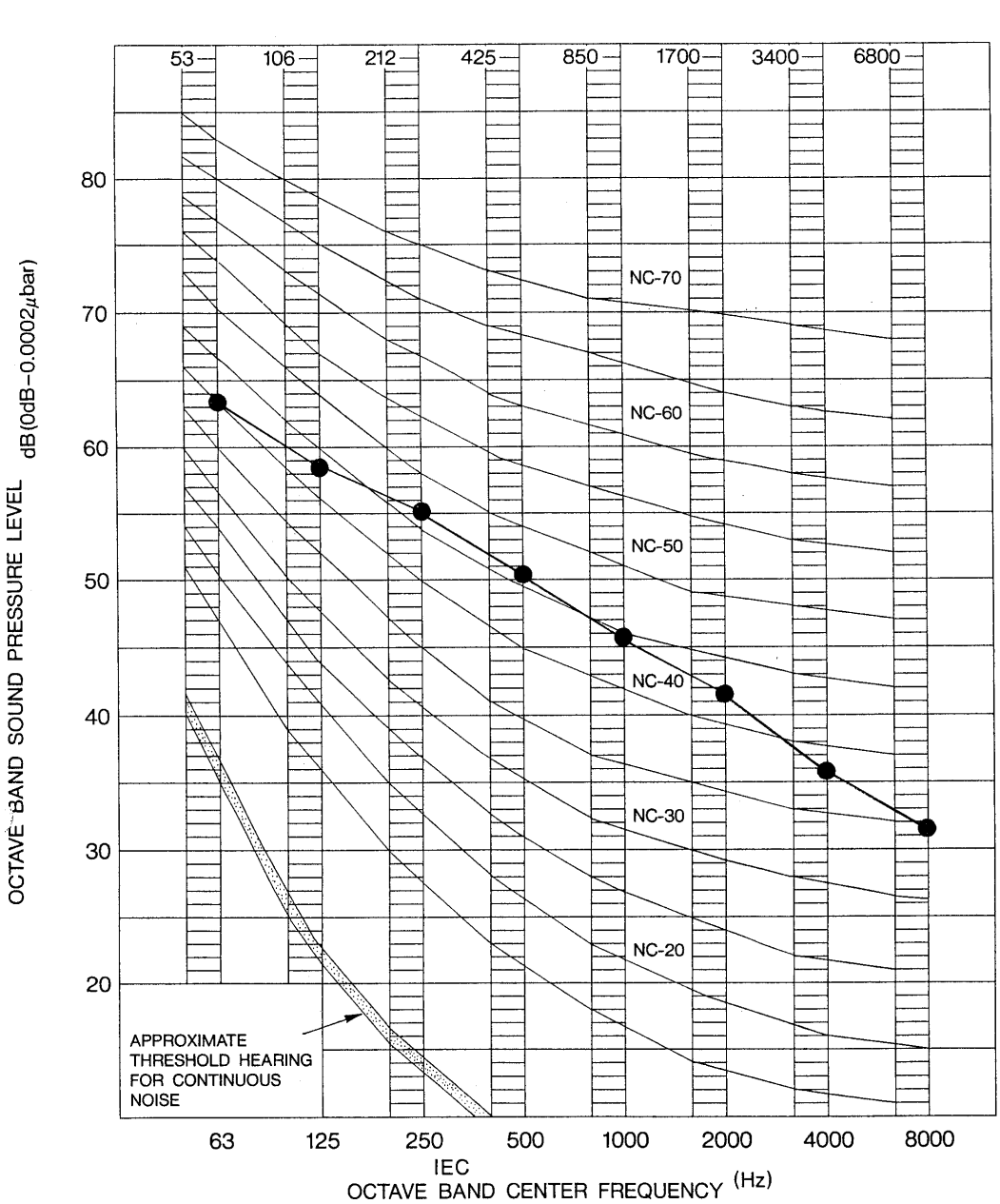
Front	Rear	Side	
		right	left
53	53	51	52

Noise measuring conditions:(Semi-) anechoic room
Heating based on JIS

Note:
This operating sound value (calculated value) is measured at an anechoic room. The actual value is bigger than the calculated value because of the surrounding noise and reverberations.



2. Octave band levels (in front)



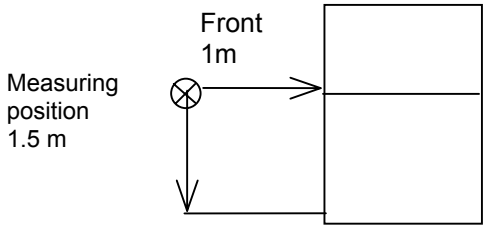
□□□ TGMP280B

1. Overall data (dB)

Front	Rear	Side	
		Right	Left
57	57	55	56

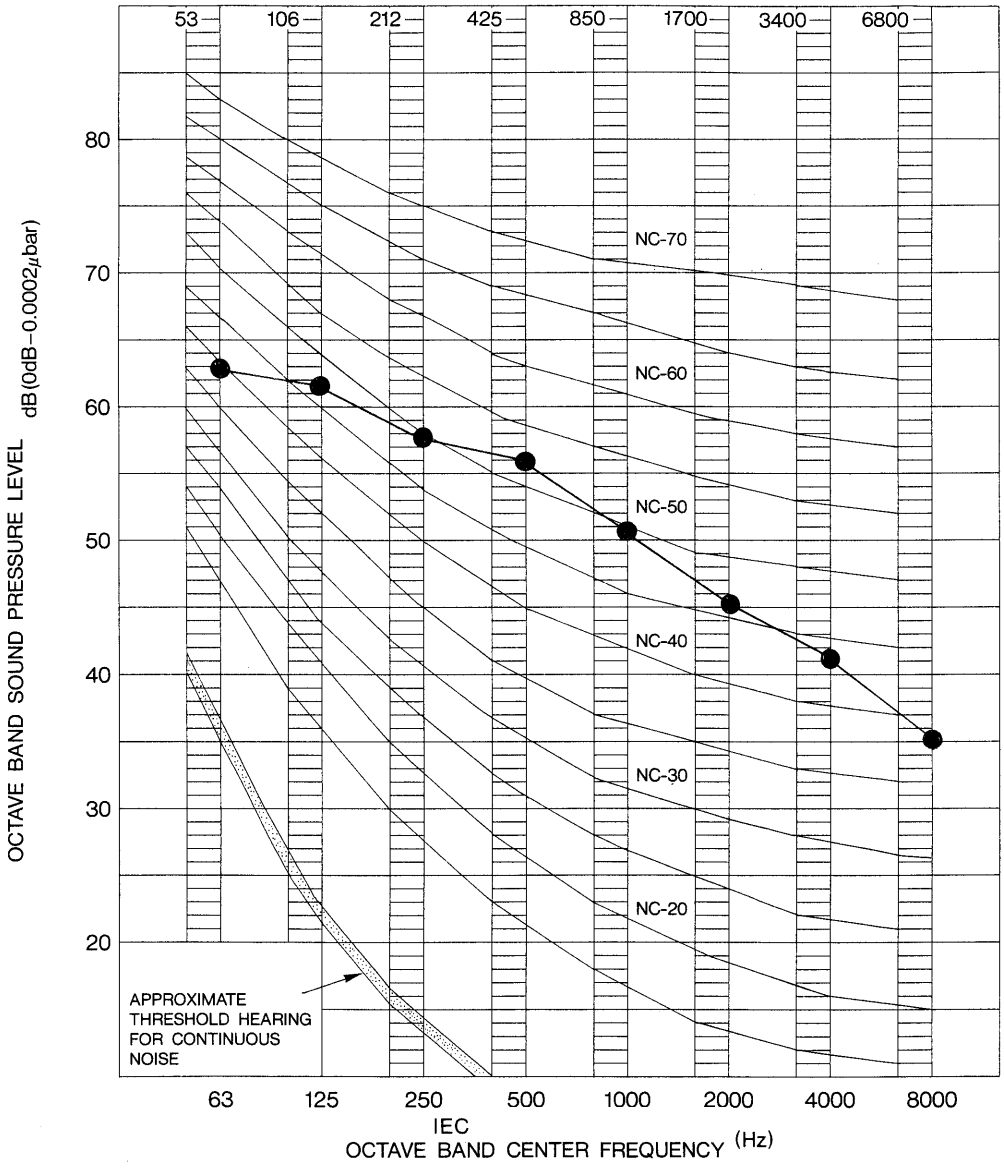
Note:
This operating sound value (calculated value) is measured at an anechoic room. The actual value is bigger than the calculated value because of the surrounding noise and reverberations.

Noise measuring conditions:(Semi-) anechoic room
Heating based on JIS



2. Octave band levels (in front)

● ● 50/~~60Hz~~



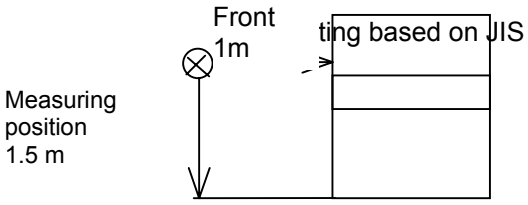
(3)TGMP355B

□Overall data (dB)

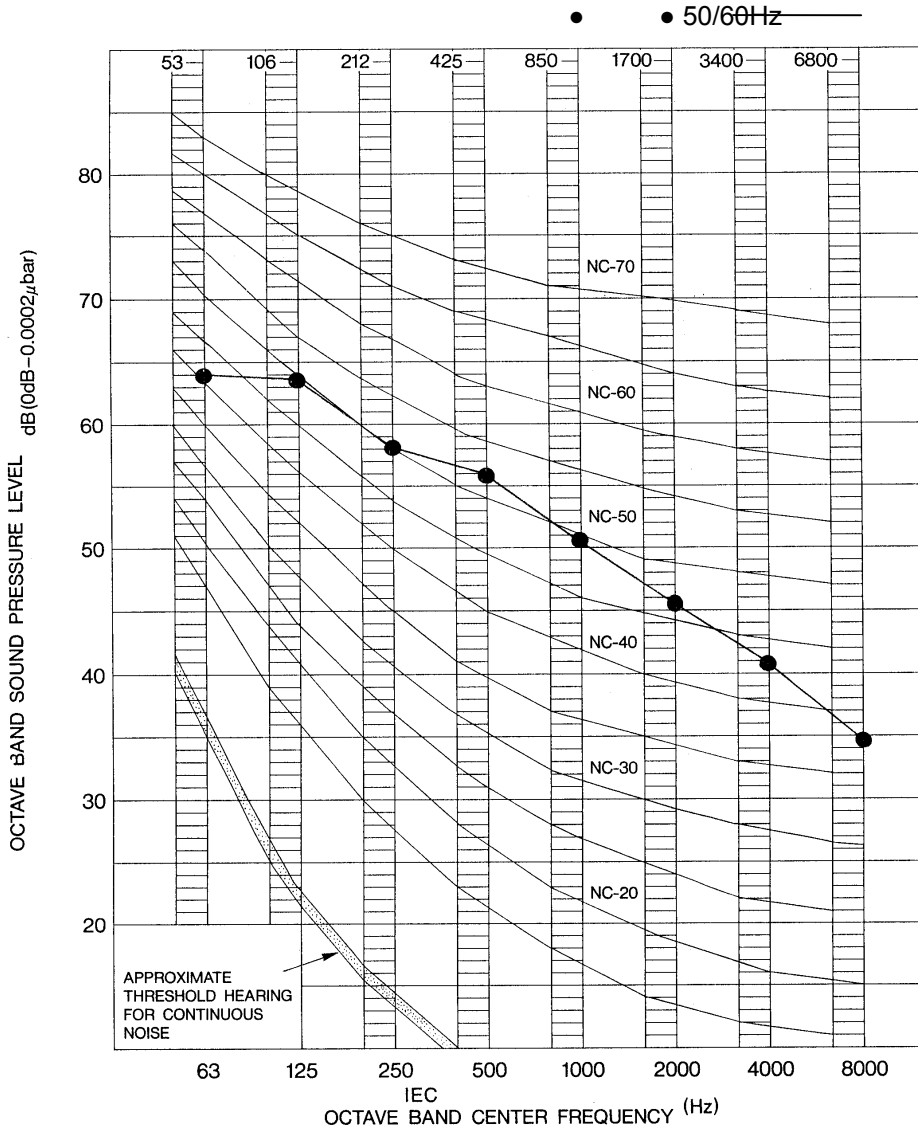
Front	Rear	Side	
		Right	Left
58	58	55	56

Note:
This operating sound value (calculated value) is measured at an anechoic room. The actual value is bigger than the calculated value because of the surrounding noise and reverberations.

Noise measuring conditions:(Semi-) anechoic room



□Octave band levels (in front)



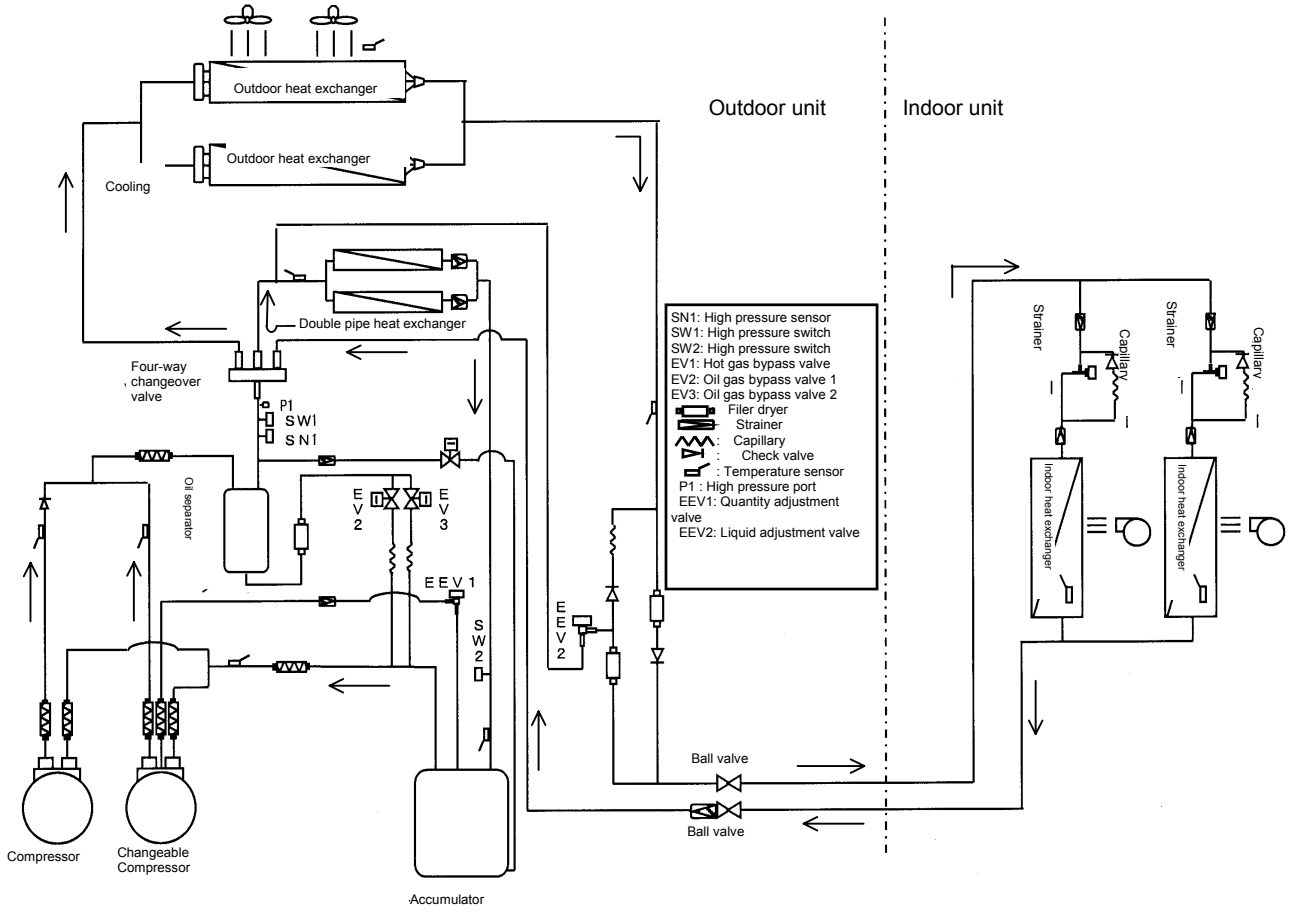
1.6 System flow chart

1.6.1 Refrigerant System Diagram

(1) Cooling

The refrigerant (Freon R407C), after exiting the compressor, first flows through an oil separator and a four-way changeover valve.

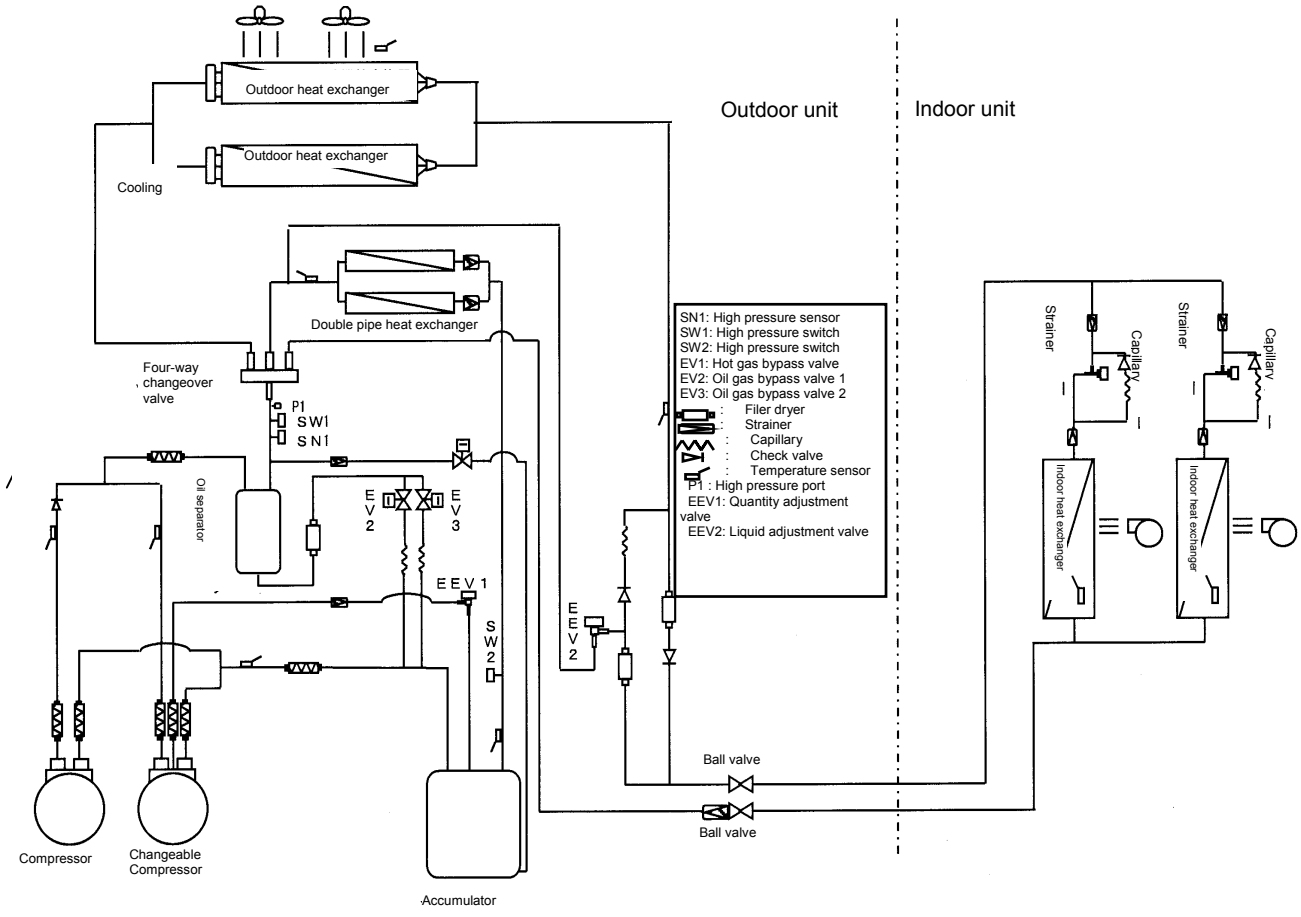
Next, the refrigerant is introduced into an outdoor heat exchanger, where it is then derived of heat by outside air to change into condensed and liquefied form. The refrigerant liquid is further cooled by the supercooler coil. After this, the refrigerant liquid goes to the indoor unit and is depressurized by the electronic expansion valve within the indoor unit. Thus, the refrigerant is deprived of indoor heat to become gasified for cooling. After that, the refrigerant gas returns to the outdoor unit. In the outdoor unit, the gas returns to the compressor, passing through the four-way valve and the accumulator.



(2) Heating

The refrigerant (Freon R407C), after exiting the compressor, first flows through an oil separator and a four-way changeover valve. Next, the refrigerant is introduced into an indoor heat exchanger (indoor unit), where it then releases internal heat to the room and is condensed and liquefied.

After this, the refrigerant is depressurized by the electronic expansion valve within the outdoor unit and by a capillary tube. After flowing through the capillary tube, the refrigerant is introduced into an outdoor heat exchanger, where it then absorbs heat and is gasified. Then, after the refrigerant joins with the refrigerant that absorb heat from the outside air and goes through four way changeover valve, the refrigerant absorb heat from engine exhaust heat in double pipe heat exchanger and gasified. The refrigerant returns to the compressor through an accumulator.



1.6.2 Coolant/Fuel/Air System/oil supply Diagram and description

Coolant

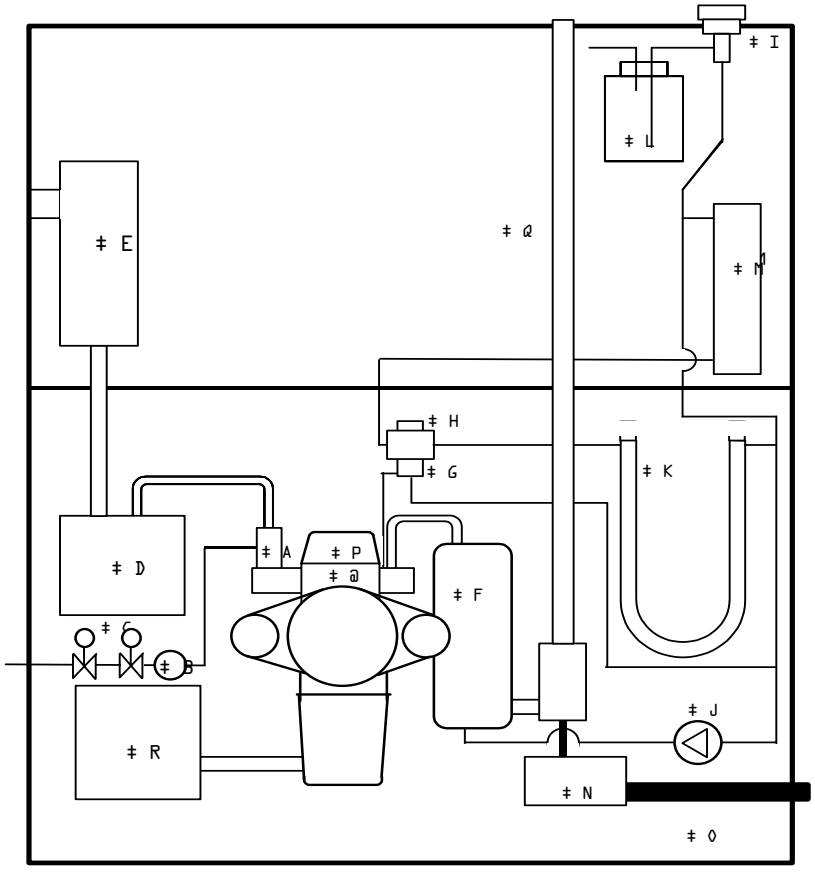
In heating or low-temperature cooling modes, the coolant that has been sent from the coolant pump and heated through the exhaust heat exchanger and the engine flows into the double pipe heat exchanger and heats the refrigerant to contribute to the improvement of heating and evaporating capabilities. In cooling mode, when there is no need for heat to be released through the double-pipe heat exchanger, an increase in the coolant temperature changes over the motor-driven three-way valve to the radiator and returns the coolant to the coolant pump after heat has been released through the radiator.

Fuel

The fuel gas is passed through a dual-type gas-operated solenoid valve unit, then depressurized to an atmospheric pressure by a gas regulator, and supplied to a gas mixer. The high-pressure section of the fuel line is isolated from the engine room to ensure safety.

Intake air and exhaust gas

Intake air is passed into the mixer through a silencer and an air cleaner, then mixed with the fuel, and enters the engine cylinders.
Exhaust gas releases heat in the exhaust heat exchanger and then the gas itself is released to the atmosphere through the exhaust air pipe. The condensate that has been generated by the release of heat from the exhaust gas is temporarily collected into a drain filter and then released from the unit through a drain hose.



☐Engine ☐Exhaust air heat exchanger ☐Double pipe heat exchanger ☐Exhaust air pipe
☐Gas mixer ☐Temperature control valve ☐Reservoir tank ☐Oil sub-tank
☐Gas regulator ☐Electric three-way valve ☐Radiator
☐Gas electromagnetic valve ☐Coolant inlet ☐Drain filter
☐ Air cleaner ☐Coolant pump ☐Exhaust air drain hose
☐Intake air silencer ☐Water temperature sensor

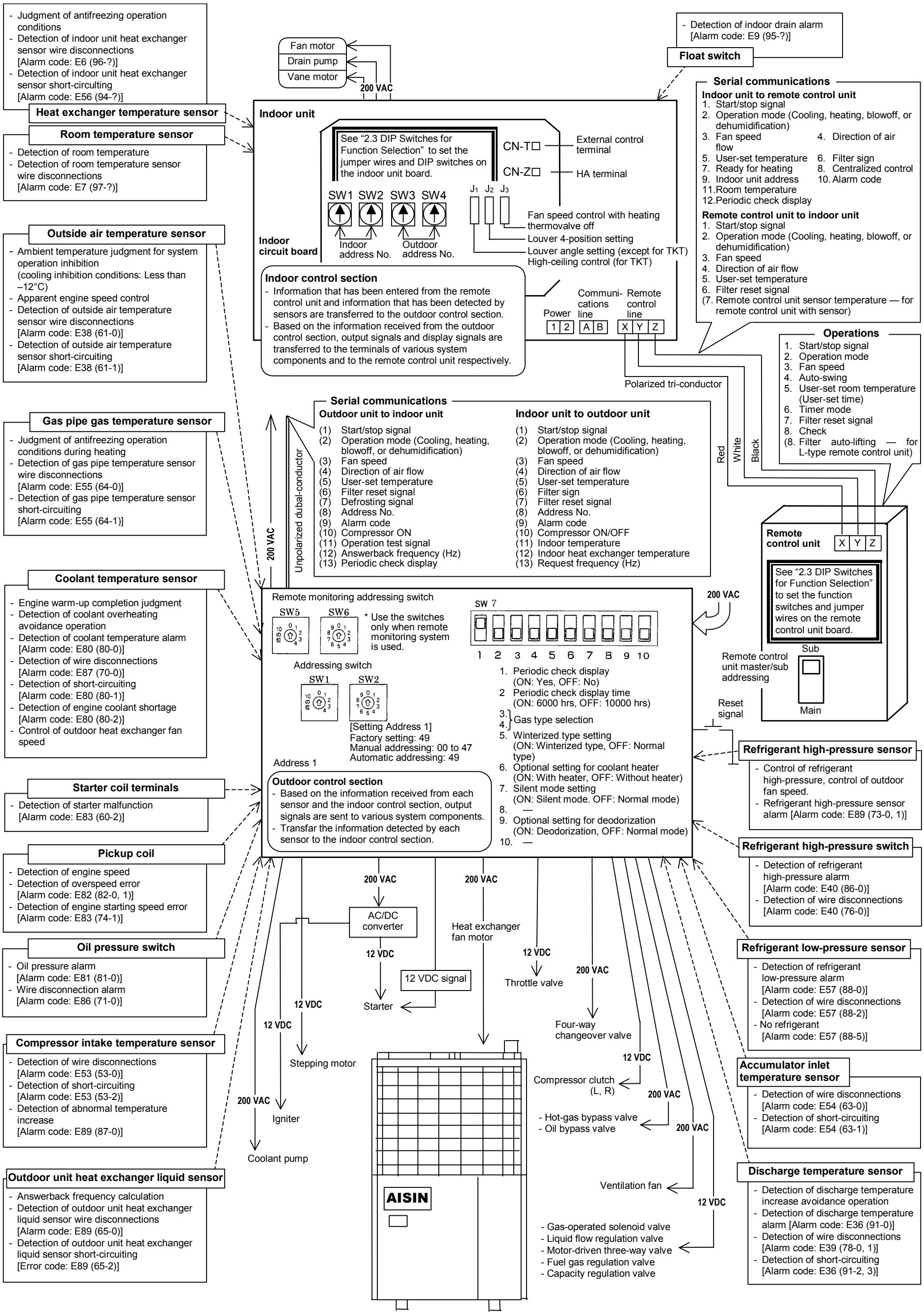
CONTROL

Chapter 2

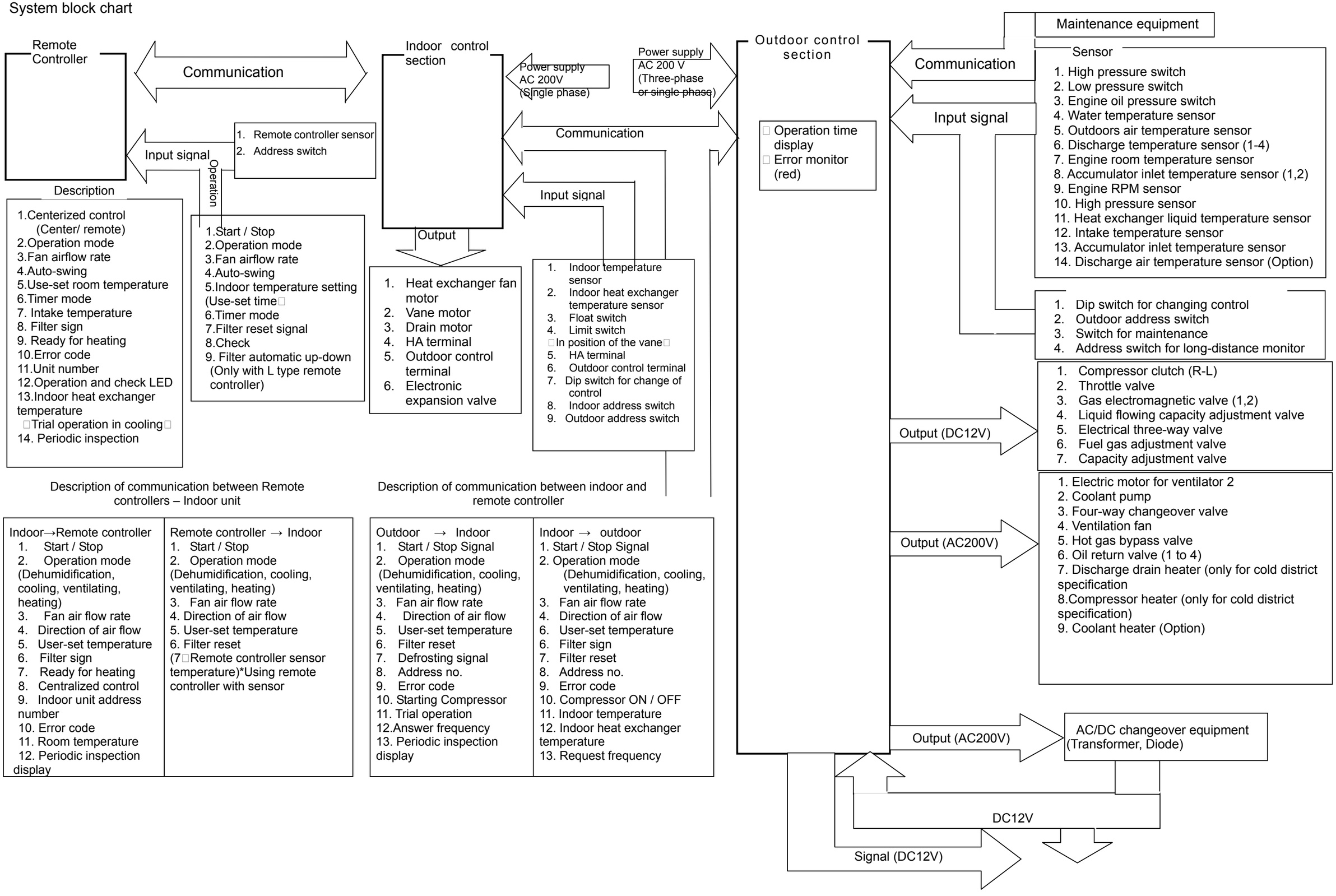
CONTROL

NOTE

2.1 System Control Function List



System block chart



Description of communication between Remote controllers – Indoor unit

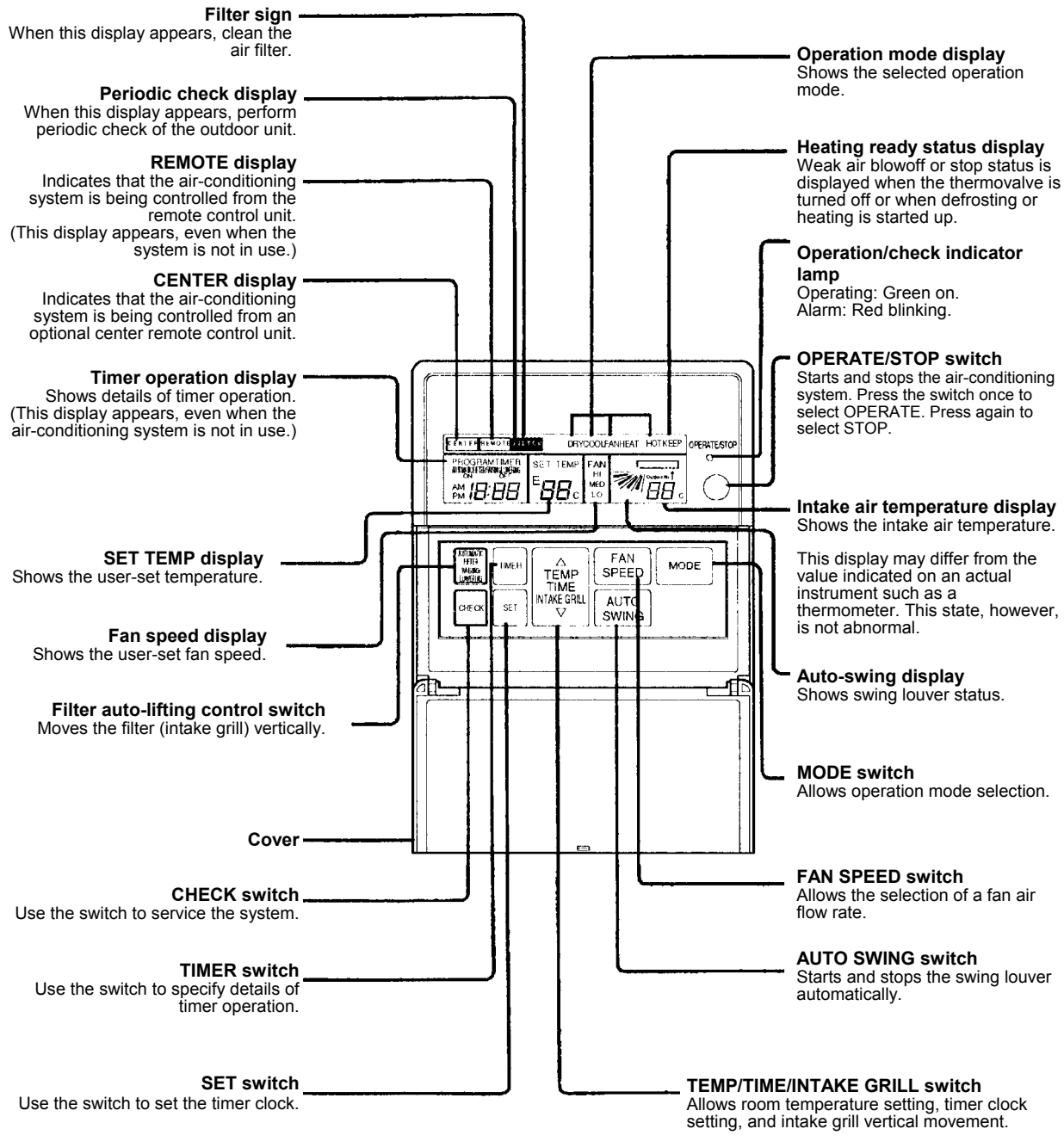
Indoor→Remote controller	Remote controller → Indoor
1. Start / Stop 2. Operation mode (Dehumidification, cooling, ventilating, heating) 3. Fan air flow rate 4. Direction of air flow 5. User-set temperature 6. Filter sign 7. Ready for heating 8. Centralized control 9. Indoor unit address number 10. Error code 11. Room temperature 12. Periodic inspection display	1. Start / Stop 2. Operation mode (Dehumidification, cooling, ventilating, heating) 3. Fan air flow rate 4. Direction of air flow 5. User-set temperature 6. Filter reset (7 Remote controller sensor temperature)*Using remote controller with sensor

Description of communication between indoor and remote controller

Outdoor → Indoor	Indoor → outdoor
1. Start / Stop Signal 2. Operation mode (Dehumidification, cooling, ventilating, heating) 3. Fan air flow rate 4. Direction of air flow 5. User-set temperature 6. Filter reset 7. Defrosting signal 8. Address no. 9. Error code 10. Starting Compressor 11. Trial operation 12.Answer frequency 13. Periodic inspection display	1. Start / Stop Signal 2. Operation mode (Dehumidification, cooling, ventilating, heating) 3. Fan air flow rate 4. Direction of air flow 6. User-set temperature 6. Filter sign 7. Filter reset 8. Address no. 9. Error code 10. Compressor ON / OFF 11. Indoor temperature 12. Indoor heat exchanger temperature 13. Request frequency

2.2 Remote Control Unit Functions

(The following view shows the remote control unit with its cover opend.)



2.3 DIP Switches for Function Selection

(1) Indoor unit

– Jumper wire connection

No.	Function		Setting	Description
J1	Other than TKT	Louver angle selection (Indoor unit types only)	Connected (ON)	TKTW, TKTC
			Not connected (OFF)	TKTS, TKE, TKK
	TKT	High-ceiling control	Connected (ON)	Normal
			Not connected (OFF)	High-ceiling control
J2	Louver control		Connected (ON)	Intermittent operation
			Not connected (OFF)	Stop at any position
J3	Fan speed with heating thermovalve off		Connected (ON)	Weak air blowoff
			Not connected (OFF)	Stop
J4	Filter sign		Connected (ON)	On after 600 hours
			Not connected (OFF)	Invalid
J5	Operation control		Connected (ON)	Normal
			Not connected (OFF)	CN-T input ON: Operation enabled. OFF: Operation inhibited.
J6	Expansion valve control		Connected (ON)	Automatically identified
			Not connected (OFF)	New angle fixed

– DIP switch assembly SW5 setting

No.	Function	Setting	Description
SW5-1	CN-1 remote start/stop input	ON	Inversion input
		OFF	Edge input
SW5-2	Heating temperature correction	ON	–3°C
		OFF	Normal
SW5-3	Drain pump	ON	Forced operation
		OFF	Normal
SW5-4	Set to OFF.		

– DIP switch assembly SW6 setting

	P22	P28	P36	P45	P56	P71	P80.90	P112	P140	P160	P224	P280
SW6-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
SW6-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
SW6-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF
SW6-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON

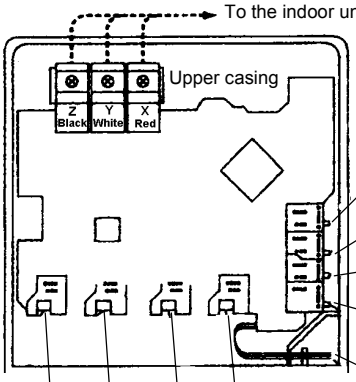
Note:
Type select switch assembly SW6 is set to the appropriate status (default) according to the particular capacity of the indoor unit(s). Do not disturb this setting.

– DIP switch assembly SW9 setting

No.	Function	Setting				TKT	Other than TKT
SW9-1 SW9-2	Auto-lifting stroke (downward)	2	ON	1	ON	400 (cm)	200/ — (cm)
					OFF	160 (cm)	160/200 (cm)
			OFF		ON	200 (cm)	130/160 (cm)
					OFF	130 (cm)	— /130 (cm)

(2) Remote control unit

Remove the upper casing from the remote control unit and set the switches.



[ ] : Default

Selector switches (on side of board)

Switches	Setting	Function
Type selection SW1	Cool	Cooling only (*4)
	Heat	Heat pump
Remote control sensor SW2	Yes	Valid (Main remote control unit only)
	No	Invalid (Indoor unit sensor valid)
Power interruption compensation SW3	Yes	Valid
	No	Invalid (Initialized on power interruption)
Remote control SW4 (*3)	Sub	Sub remote control (Main/sub remote control)
	Main	Main remote control

Heat-sensitive section of sensor

Jumper wire connection

Swing jumper J4 (*2)	Not connected	Display off
	Connected	Display on
Timer function jumper J3	Not connected	Invalid
	Connected	Valid
Fan speed select jumper J2 (*1)	Not connected	2-speed type Very high ↔ Low
	Connected	3-speed type Very high ↔ High ↔ Low
Intake temperature display jumper J1	Not connected	Display off
	Connected	Display on

*1: Use the table below to set fan speed select jumper J2.

J2 Jumper Setting	Type of Indoor Unit
Not connected (OFF)	TKT, TKTC, TKTW, TKTS, TKR, TKE (other than P280) TKK, TKF, TKFL, TKFU
Connected (ON)	TKU, TKUM, TKUF, TKES, TKFP, TKFD, TKE (P280)

*2: Use the table below to set swing display jumper J4.

J4 Jumper Setting	Type of Indoor Unit
Not connected (OFF)	TKR, TKU, TKUM, TKUF, TKES, TKFL, TKFU,TKFP,TKFD
Connected (ON)	TKT, TKTC, TKTW, TKTS, TKE, TKK,TKF

*3: The check reset, filter sign reset, and auto-lifting control functions can be controlled only with the main remote control unit.

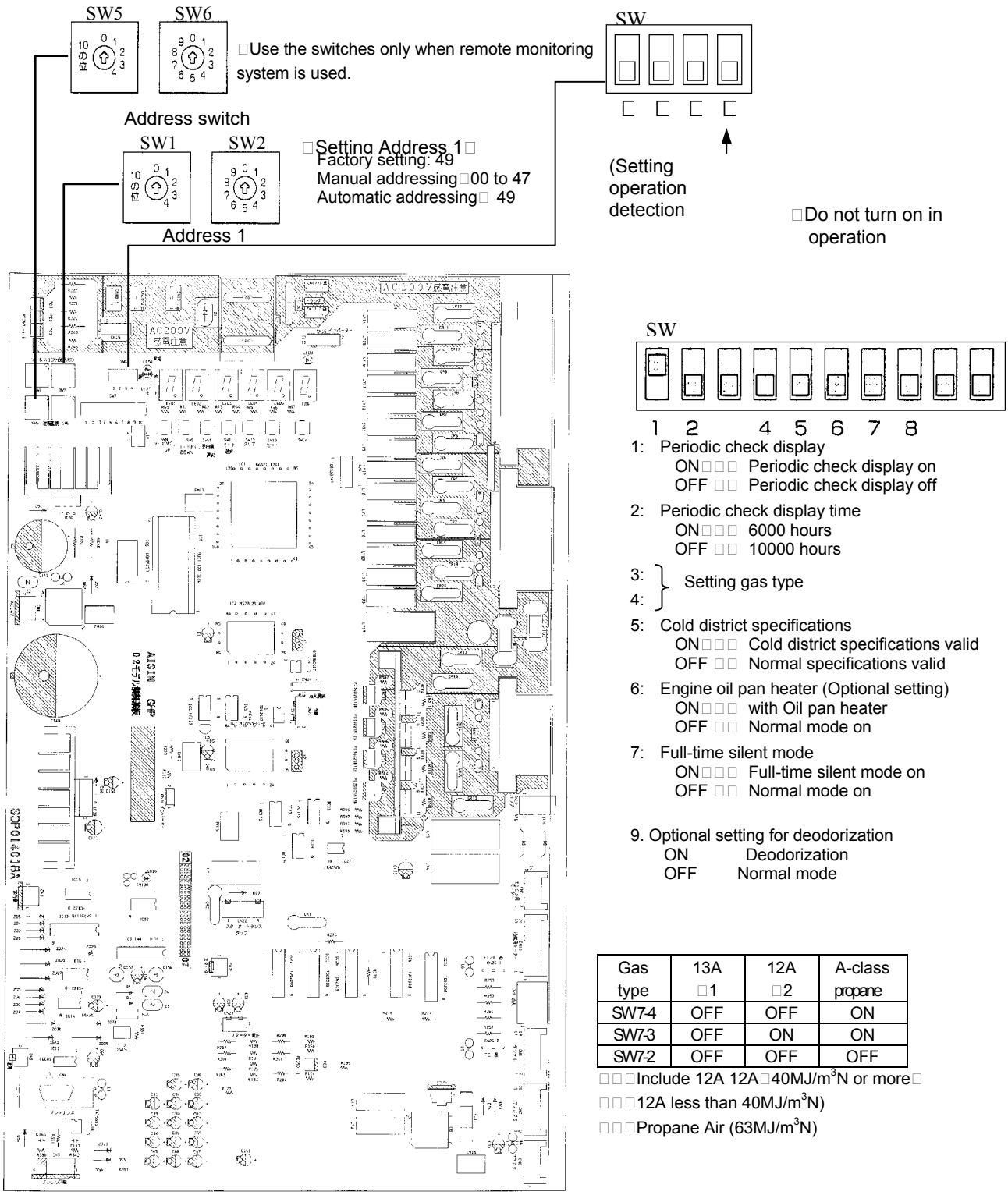
*4: The indoor unit TKUF is used only for cooling. Set SW1 to Cool.

Note:

To operate the system in cooling test mode, first press the OPERATE switch and select cooling mode. Next, press the SET switch while holding down the “TEMP ∇” switch. Thirty-minute forced cooling will be initiated. Press the STOP switch to abort the cooling operation.

Function switches on the outdoor unit control circuit board

Remote monitoring addressing switch



1: Periodic check display
ON Periodic check display on
OFF Periodic check display off

2: Periodic check display time
ON 6000 hours
OFF 10000 hours

3: } Setting gas type
4: }

5: Cold district specifications
ON Cold district specifications valid
OFF Normal specifications valid

6: Engine oil pan heater (Optional setting)
ON with Oil pan heater
OFF Normal mode on

7: Full-time silent mode
ON Full-time silent mode on
OFF Normal mode on

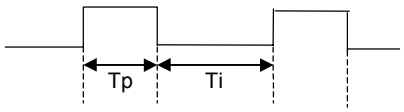
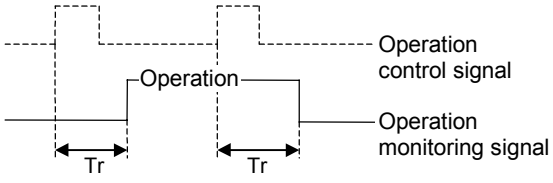
9. Optional setting for deodorization
ON Deodorization
OFF Normal mode

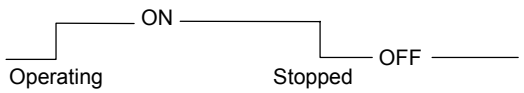
Gas type	13A 1	12A 2	A-class propane
SW7-4	OFF	OFF	ON
SW7-3	OFF	ON	ON
SW7-2	OFF	OFF	OFF

Include 12A 12A 40MJ/m^{3}N or more
12A less than 40MJ/m^{3}N)
Propane Air (63MJ/m^{3}N)

2.4 System Input/Output Specifications

2. 4. 1. Indoor Unit Input/Output Specifications

No.	Name	Functions	Electrical Component Specs.	Connector No.
1	Indoor temperature sensor	(1) Temperature control (2) Cooling/heating changeover during automatic operation (3) Indoor fan speed control during dehumidification	Thermister R_{25} = 5 kΩ B = 3950 k	CNH, pins 1 and 2
2	Indoor heat exchanger sensor	(1) Control of hot-starting (2) Antifreezing control (3) Display of remotely controlled heat exchanger temperature in operation test mode	Thermister R_{25} = 5 kΩ B = 3950 k	CNH, pins 3 and 4
3	Float switch	(1) Detection of drainage alarm Normal: ON Abnormal: OFF	OFF: 200 VAC ON: 10 VAC or less	FASTON 9-5
4	Vane position (Limit switch)	(1) Cycle time self-learning and control by power feeding to motor immediately after power-on (2) Louver horizontal position detection	Voltage applied: 5 VDC Rated current: 5 mA	CNS
5	Rotary switches	(1) Indoor unit addressing with blue SW1 and SW2 Manual addressing: 0 to 47 Automatic addressing: 49 (2) Outdoor unit addressing with green SW3 and SW4 Manual addressing: 0 to 47 Automatic addressing: 49	SW1: Address (10's place) SW2: Address (1's place) SW3: Address (10's place) SW4: Address (1's place)	
6	HA terminals	(1) OPERATE/STOP instruction – The operation control signal waveform is shown below. – This signal is used for the gas heat pump to reverse the OPERATE/STOP signal level.  Tp: Pulse "on" time (200 - 300 msec) Ti: Pulse interval (200 msec or more) (2) Operation monitoring signal – Gas heat pump on/off status output signal (Static signal)  Tr: Response time (300 msec or less)	Based on Japanese Electric Machine Industrial Standard JEM1427-1987	CNZ, pins 1 and 2 (HA) CNZ, pins 3 and 4 (HA)

No.	Name	Functions	Electrical Component Specs.	Connector No.
7	External control terminals	(1) Operation monitoring output □□ On when remote control unit is on (2) Heating mode monitoring output □□ On during heating (except for defrosting) (3) Compressor monitoring output □□ On when compressor is on (4) Alarm monitoring output □□ On in case of alarm (5) OPERATE/STOP instruction  Operation starts and stops with the rising and falling edges, respectively, of the signal. **Note:** When pin 1 of DIP SW5 is on, the OPERATE/STOP signal level is reversed at the rising edge of the signal shown above.	Can be driven at 12 VDC/ 75 mA with the OMRON LY2F relay.	CNT, pins 1 and 2 CNT, pins 1 and 3 CNT, pins 1 and 4 CNT, pins 1 and 5 CNT, pins 1 and 6
8	Heat exchanger fan (Low)	Fan speed can be changed by tap changeover. (1) Specification of fan speed from remote control unit (2) Control of hot-starting (3) Dehumidification **Note:** TKU is of the two-speed type (“High” and “Very high” select lines are connected outside the circuit board). TKF and TKFD are of the single-speed type. (4) Heating thermovalve-off intermittent operation (without J-3)	200 VAC	FASTON tab 5 and 8
	Heat exchanger fan (High)			FASTON tab 5 and 7
	Heat exchanger fan (Very high)			FASTON tab 5 and 6
9	Vane motor	The vane motor controls the louver. (1) Specification of air flow direction from remote control unit (2) Control of hot-starting The stopping position of the louver differs according to the type of indoor unit used. J-1 connected: TKTS or TKE type J-1 not connected: Other types	200 VAC	FASTON tab 3 and 5
10	Drain pump	(1) On during cooling or dehumidification when compressor is on. (2) On when float switch is off. (3) Turned off two minutes after float switch-on.	200 VAC	FASTON tab 4 and 5
11	Fan controller	(1) The fan speed from the TKU type of indoor unit can be continuously adjusted with the appropriate control.	200 VAC	

2.4.2 Outdoor Unit Input/Output Specifications

No.	Name	Functions	Electrical Component Specs.	Connector No.
1	Refrigerant high-pressure switch	(1) Stoppage judgment associated with unusually high pressure (2) Detection of refrigerant high-pressure switch wire disconnections	Contact point switch (12 VDC) Normal: ON	CN8, pins 3 (black) and 4 (black)
2	Heat exchanger liquid temperature sensor	(1) Answer frequency calculation (correction of supercooling) (2) Wire disconnection/short-circuiting detection for heat exchanger liquid temperature sensor	Thermister R_0 = 15 kΩ B = 3450 k	CN6, pins 1 (white) and 2 (white)
3	Heat exchanger gas temperature sensor	(1) Frosting detection during heating (2) Refrigerant high-pressure error avoidance control during cooling (3) Wire disconnection/short-circuiting detection for heat exchanger gas temperature sensor	Thermister R_0 = 15 kΩ B = 3450 k	CN6, pins 9 (white) and 10 (white)
4	Outside air temperature sensor	(1) System operation inhibition ambient temperature judgment (Inhibition of operation: Below –12°C during cooling) (2) Control of oil returning valve (3) Wire disconnection/short-circuiting detection for outside air temperature sensor (4) Control of outdoor fan quantity	Thermister R_0 = 15 kΩ B = 3450 k	CN6, pins 15 (white) and 16 (white)
5	Compressor discharge temperature sensor	(1) Compressor discharge temperature alarm judgment (2) Compressor discharge temperature alarm avoidance control (3) Wire disconnection/short-circuiting detection for compressor discharge temperature sensor	Thermister R_0 = 15 kΩ B = 4095 k	R: CN6, pins 7 and 8 L: CN6, pins 5 and 6
6	Compressor intake temperature sensor	(1) Wire disconnection/short-circuiting detection for compressor intake temperature sensor (2) Oil returning error detection (3) Compressor intake temperature alarm avoidance control	Thermister R_0 = 15 kΩ B = 3450 k	CN6, pins 11 (white) and 12 (white)
7	Accumulator inlet temperature sensor	(1) Wire disconnection/short-circuiting detection for accumulator inlet temperature sensor (2) Oil returning error detection	Thermister R_0 = 15 kΩ B = 3450 k	CN6, pins 3 (white) and 4 (white)
8	Engine coolant temperature sensor	(1) Engine coolant alarm judgment (2) Engine warm-up completion judgment (3) Engine coolant alarm avoidance control (4) Engine coolant no-load operation preventive control (5) Wire disconnection/short-circuiting detection for engine coolant temperature sensor (6) Outdoor fan speed control	Thermister R_{100} = 3.3 kΩ $B_{0/100}$ = 3970 k	CN7, pins 9 (black) and 12 (white)
9	High-pressure sensor	(1) Refrigerant high-pressure control (for maintaining high pressure in heating mode) (2) Refrigerant high-pressure error avoidance control (3) Outdoor fan speed control (4) Answer frequency calculation (correction of supercooling)	5 ± 0.5 VDC	CN7, pins 8 (red) and 4 (black)
10	Low-pressure switch	(1) Low-pressure abnormality stop judgment (2) Detection of refrigerant low-pressure switch wire disconnections	Contact point switch (12 VDC) Normal: ON	CN8, pins 1 (black) and 2 (black)

No.	Name	Functions	Electrical Component Specs.	Connector No.
11	Engine revolutions signal (crank angle sensor)	(1) Detection of engine revolutions		
12	Engine oil pressure switch	(1) Oil pressure abnormality judgment (2) Detection of engine oil pressure switch wire disconnections	ON: 1 VDC or less OFF: 11 to 13 VDC	CN8, pins 17 (brown) and 18 (yellow)
13	Starter malfunction detection signal	(1) Starter malfunction detection (2) Starter trouble and wire disconnection detection		CN23, pin 1
14	Compressor clutches (L, R)	(1) Turns on in accordance with a request frequency instruction from the indoor unit, but only when the inhibition timer is off. (2) Control of refrigerant flow rate (quantitative control of units to be operated)	12 VDC/4 A	R: CN12, pin 2 L: CN12, pin 1
15	Starting motor	(1) Support for autonomous engine start	11 to 19 VDC	Motor plus terminal to ground
16	Igniter	(1) Controls the ignition timing of the three-cylinder engine ignition coils.	12 VDC	IGN-H, C
17	Stepping motor for engine control	(1) Control of engine revolutions **Note:** For details see “Stepping Motor Control”.	Structure: 4-phase PM Excitation: 1-2 phase Single-step angle: 0.15°	CN11
18	Coolant pump	(1) Circulation of engine coolant	200 VAC	CN13, pins 5 (black) and 9 (white)
19	Ventilation fan	(1) Internal ventilation of engine room	200 VAC	CN14, pins 3 (white) and 10 (black)
20	Four-way changeover valve	(1) On during heating **Note:** This valve is activated either 60 sec after turning on the both compressors or if a differential pressure of 0.2 MP between the high-pressure and low-pressure circuits persists for 10 sec in succession. The valve is switched when an operation mode different from the previous mode is selected or when power is turned on.	200 VAC	CN15, pins 2 (black) and 11 (black)
21	Gas electro-magnetic valve 1	(1) Supply and shutoff of fuel gas to outdoor unit	10 to 16 VDC (Full-wave rectification of 14 VAC)	CN7, pins 19 (white) and 20 (white)
22	Gas electro-magnetic valve 2			CN7, pins 17 (black) and 18 (black)
23	Heat exchanger fan motor 1	(1) Four-level control (H, M, L, UL) when the thermovalve is open during cooling (2) Single-level control (H) when the thermo-valve is open during heating (3) Stop when defrosting in heating mode is necessary or the thermovalve is closed	200 VAC/100 W	CN13, pins 2 and 7
24	Heat exchanger fan motor 2 — High			CN13, pins 3 and 4
	Heat exchanger fan motor 2 — Low			CN13, pins 3 and 8
25	Oil returning valve 1	(1) Operates in oil returning valve control mode. The amount of oil return within the required range is obtained from OCR calculation results.	200 VAC/7 W	CN15, pins 9 and 17
26	Oil returning valve 2			CN15, pins 8 and 16
27	Liquid flow regulating valve	(1) Controls the liquid flow valve to stabilize the compressor intake temperature and discharge temperature. (2) Defrosting operation during heating	Structure: 4-phase PM Excitation: 2 phase	CN10-1 to 7

2.4 Protection Units

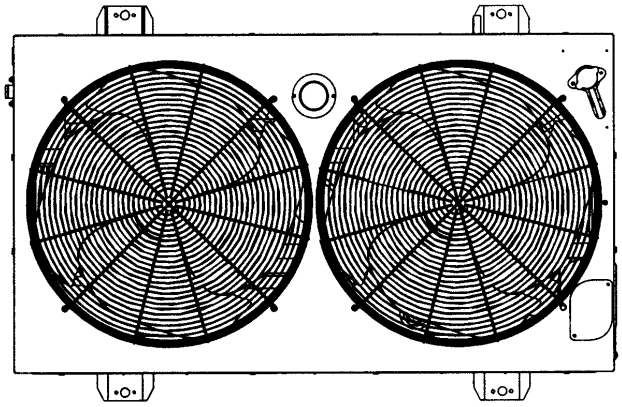
2.4.1 Protection Units and Sensor Functions

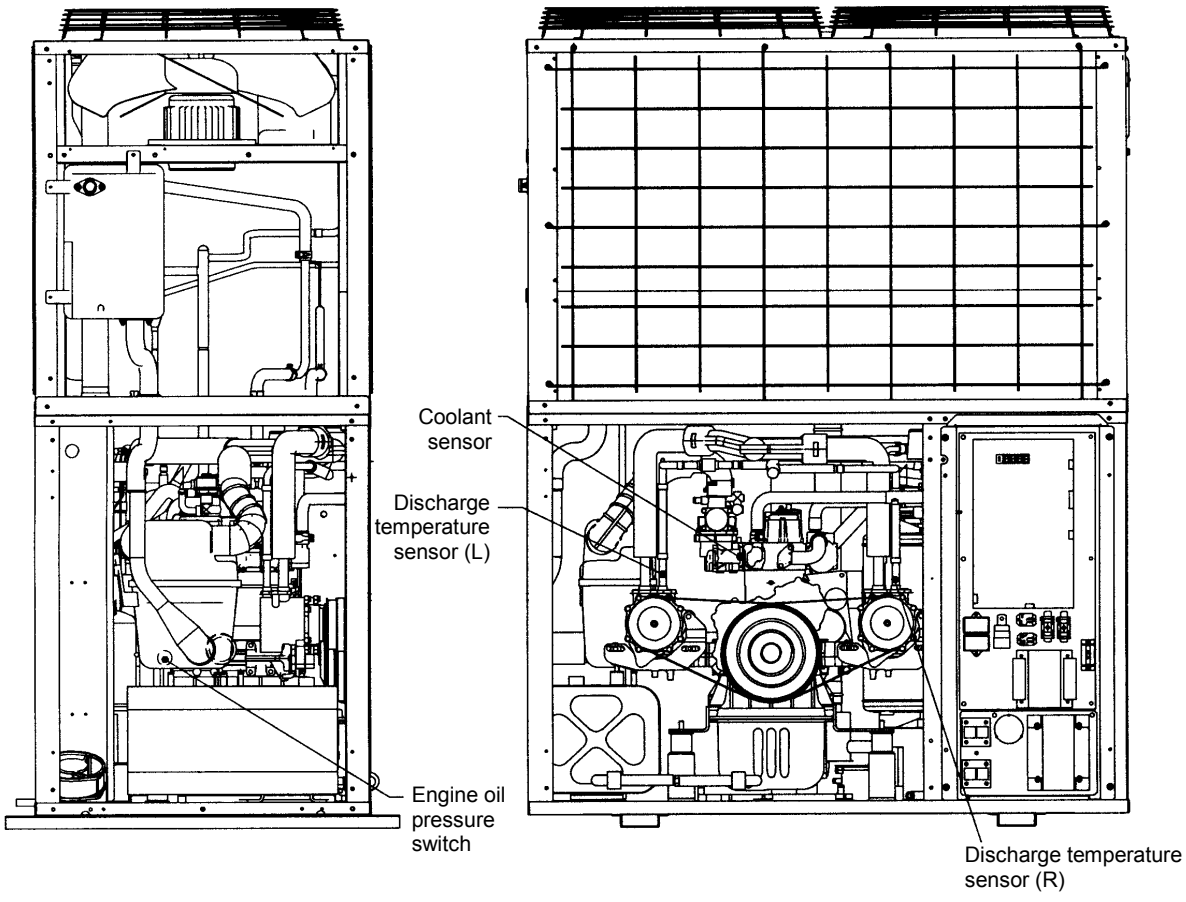
Protection Unit		Error Item	Check Display		
Detector	Control Connector		Remote Control Unit	Maintenance Board	Red LED Blinking
Starter malfunction detection signal	On the outdoor unit board CN23-1	Starter malfunction	E83	60-0	Continuous
Engine speed signal Pickup coil	On the outdoor unit board CN5	Engine speed too high	E82	82-0	
				82-1	
		Insufficiency of starting engine speed	E83	74-1	
		Engine speed control error		74-4	
		Engine speed hunting error	—	74-6	
		Engine starting failure	E84	84-0	
		Engine stop	E85	75-0	
		Engine micon communication error	—	84-3	
		Engine program input malfunction	—	84-4	
Coolant temperature sensor	On the outdoor unit board CN7-9, 12	Engine coolant temperature too high	E80	80-0	
		Engine coolant temperature sensor short-circuiting		80-1	
		No engine coolant		80-2	
		Engine coolant temperature sensor wire disconnections	E87	70-0	
Oil pressure switch	On the outdoor unit board CN8-17, 18	Engine oil pressure error	E81	81-0	
		Engine oil pressure switch wire disconnections	E86	71-0	
Refrigerant high-pressure switch	On the outdoor unit board CN8-3, 4	Refrigerant high-pressure switch wire disconnections	E40	76-0	
		Refrigerant high-pressure error		86-0	
High-pressure sensor	On the outdoor unit board CN7-3, 4	High-pressure sensor error	E89	73-0	
				73-1	
Refrigerant low-pressure switch	On the outdoor unit board CN8-1, 2	Refrigerant low-pressure error	E57	88-0	
		Refrigerant low-pressure switch wire disconnections		88-2	
		No refrigerant		88-5	
Compressor discharge temperature sensor R/L	On the outdoor unit board R: CN6-7, 8 L: CN6-5, 6	Compressor discharge temperature too high	E36	91-0	
		Compressor discharge temperature sensor short-circuiting (R)		91-2	
		Compressor discharge temperature sensor short-circuiting (L)		91-3	
		Compressor discharge temperature sensor wire disconnections (R)	E39	78-0	
		Compressor discharge temperature sensor wire disconnections (L)		78-1	
Compressor intake temperature sensor	On the outdoor unit board CN6-11,12	Compressor intake temperature sensor wire disconnections	E53	53-0	
		Compressor intake temperature sensor short-circuiting		53-2	
		Compressor intake temperature too high	E89	87-0	

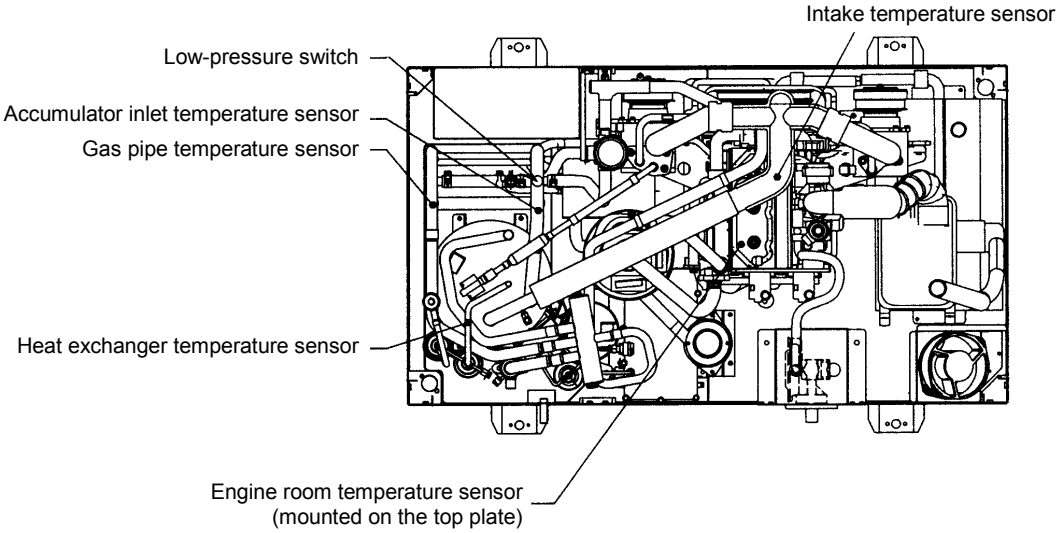
Protection Unit		Error Item	Check Display		
Detector	Control Connector		Remote Control Unit	Maintenance Board	Red LED Blinking
Accumulator inlet temperature sensor	On the outdoor unit board CN6-3, 4	Accumulator inlet temperature sensor wire disconnections	E54	63-0	Continuous
		Accumulator inlet temperature sensor short-circuiting		63-1	
Engine room temperature sensor	On the outdoor unit board CN6-13, 14	Engine room temperature sensor wire disconnections	E52	72-0	
		Engine room temperature sensor short-circuiting		75-1	
Exaust temperature sensor (option)	On the outdoor unit board CN7-13, 14	Exhaust temperature sensor wire disconnections		72-6	
		Exhaust air error	E58	47-0	
Outside air temperature sensor	On the outdoor unit board CN6-15, 16	Outside air temperature sensor wire disconnections	E38	61-0	
		Outside air temperature sensor short-circuiting		61-1	
Outdoor heat exchanger liquid temperature sensor	On the outdoor unit board CN6-1, 2	Outdoor heat exchanger liquid temperature sensor wire disconnections	E89	65-0	
		Outdoor heat exchanger liquid temperature sensor short-circuiting		65-2	
Gas pipe temperature sensor	On the outdoor unit board CN6-9, 10	Gas pipe temperature sensor wire disconnections	E55	64-0	
		Gas pipe temperature sensor short-circuiting		64-1	
		Gas electromagnetic valve output error	E83	74-7	
Outdoor unit addressing switch	On the outdoor unit board SW1, 2	Outdoor unit address number overlapping	E31	31-0	
		Outdoor unit address number setting error	—	4-0	
Communication cable	On the outdoor unit board CN26-1, 2	Indoor-outdoor communications error	—	5-0	
		Power supply connection error	—	41-1	
			—	41-2	
		Less phase error	E34	41-1	
Outdoor unit board	Inside the outdoor unit board	Communication impossible	—	50-0	
		Local send data not readable	—	50-0	
Indoor unit addressing switch	On the indoor unit board SW1, 2,	No indoor unit connected	—	3-0	
		Indoor unit address number overlapping	E2	2-0	
		Indoor unit address number setting error	E12	—	
		Too many indoor units are connected	E43	43-0	
		Mode unmatch	E61	93-?	
		Indoor units unmatch	E85	44-?	
Remote control unit wire	On the indoor unit board CnB	Communications error between remote control unit and indoor unit	E1	1-0	
		Remote controller intake temperature sensor disconnection	E28	43-0	
Communication cable	On the indoor unit board CnK	Pairing error	E3	—	
		Communications error between indoor unit and outdoor unit	E5	—	
		EEPROM error	—	40-0	
Indoor heat exchanger sensor	On the indoor unit board CNH 3-4	Indoor heat exchanger sensor wire disconnections	E6	96-?	
		Indoor heat exchanger sensor short-circuiting	E56	94-?	

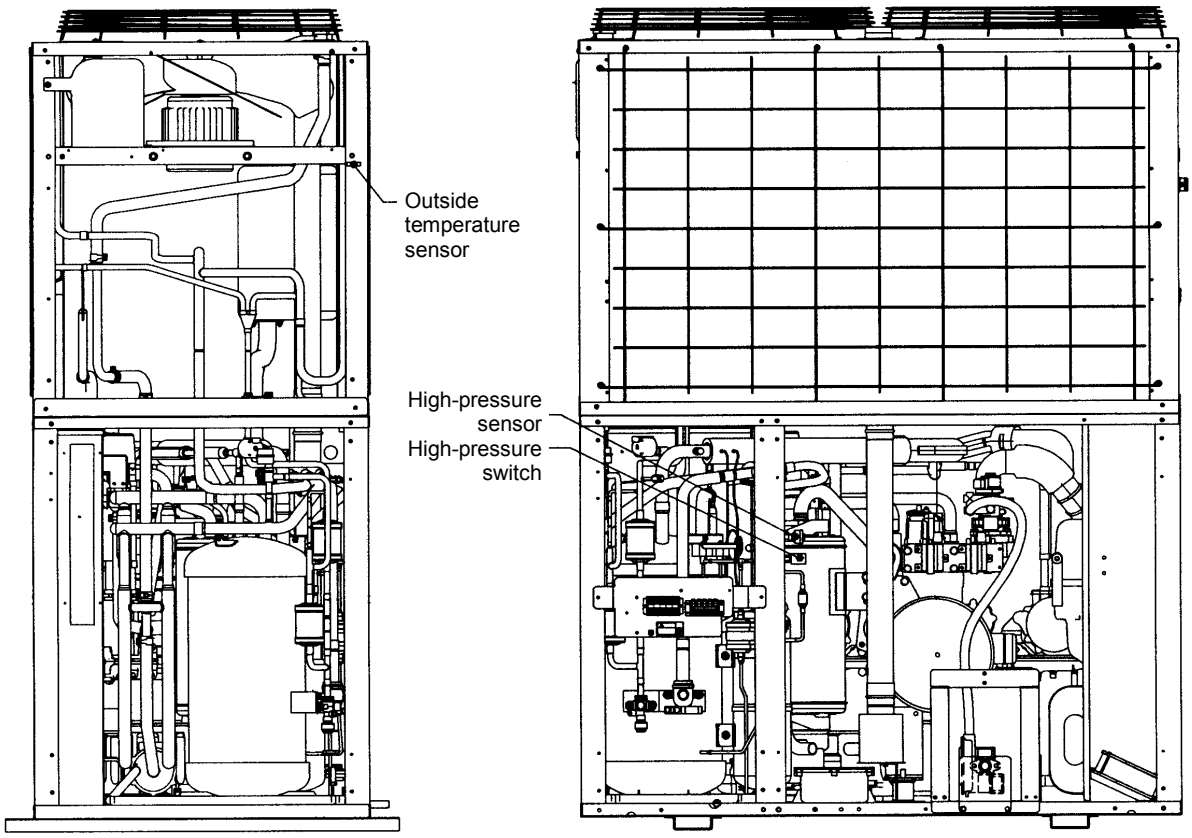
Protection Unit		Error Item	Check Display		
Detector	Control Connector		Remote Control Unit	Maintenance Board	Red LED Blinking
Indoor intake sensor	On the indoor unit board CNH 1-2	Indoor intake sensor wire disconnections	E7	97-?	Continuous
Float switch	On the indoor unit board Cnl	Indoor unit drain error	E9	95-?	

2.4.2 Sensor Mounting Positions





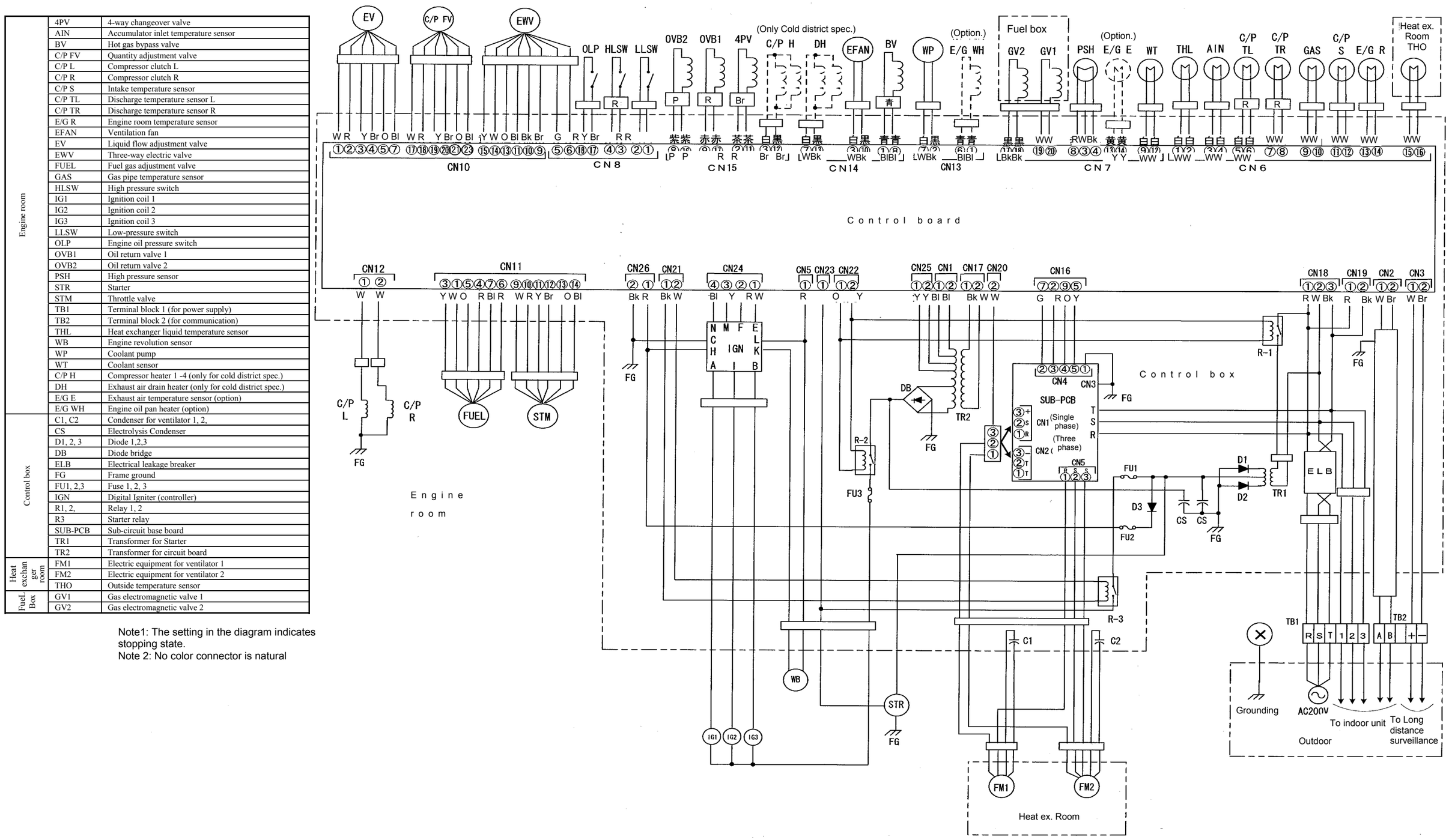

Intake temperature sensor
Low-pressure switch
Accumulator inlet temperature sensor
Gas pipe temperature sensor
Heat exchanger temperature sensor
Engine room temperature sensor
(mounted on the top plate)


Outside
temperature
sensor
High-pressure
sensor
High-pressure
switch

2.6. Outdoor unit electrical wiring diagram

2.6.1 Outdoor unit electrical wiring diagram

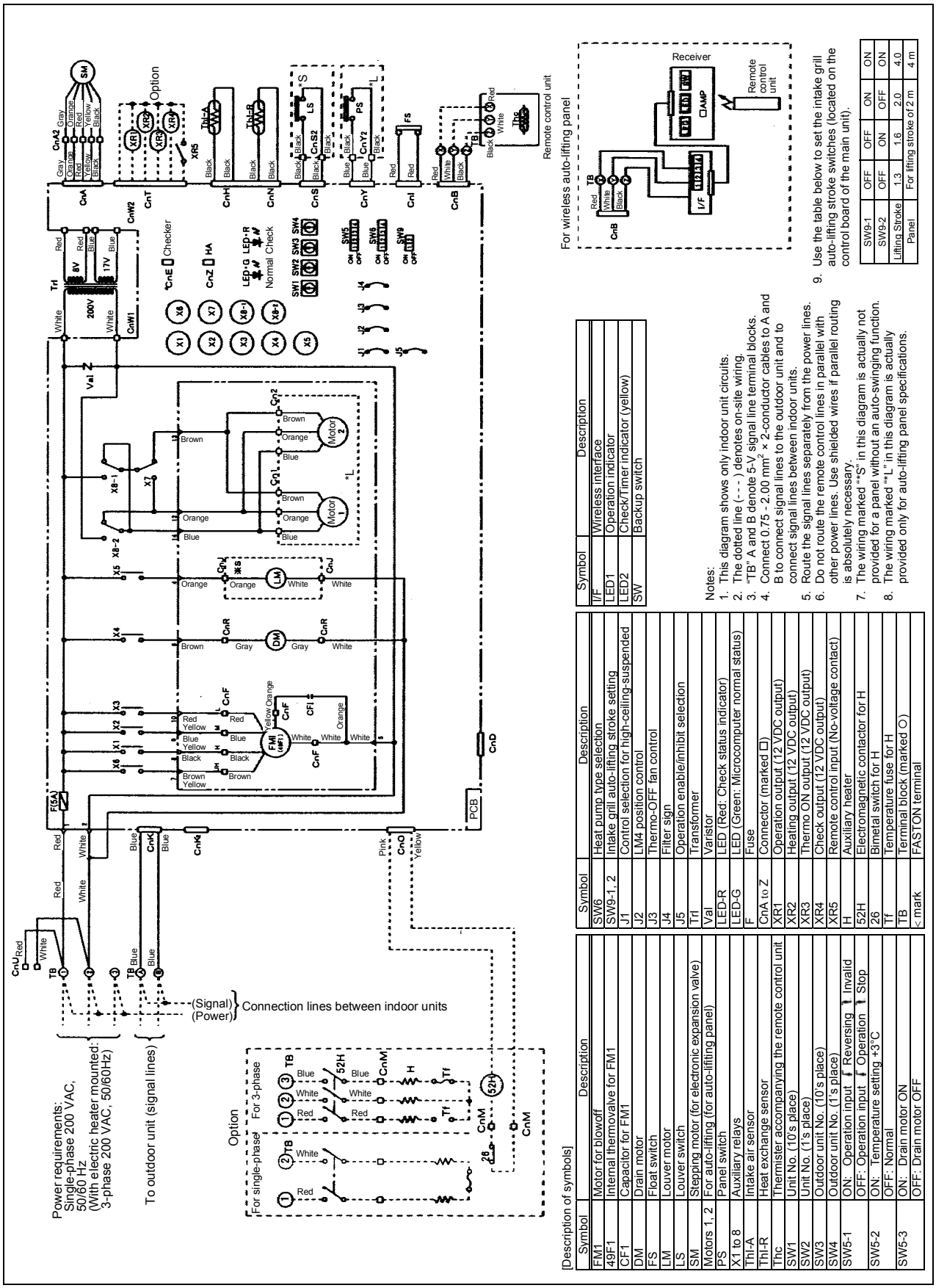
Engine room	4PV	4-way changeover valve
	AIN	Accumulator inlet temperature sensor
	BV	Hot gas bypass valve
	C/P FV	Quantity adjustment valve
	C/P L	Compressor clutch L
	C/P R	Compressor clutch R
	C/P S	Intake temperature sensor
	C/P TL	Discharge temperature sensor L
	C/P TR	Discharge temperature sensor R
	E/G R	Engine room temperature sensor
	EFAN	Ventilation fan
	EV	Liquid flow adjustment valve
	EWV	Three-way electric valve
	FUEL	Fuel gas adjustment valve
	GAS	Gas pipe temperature sensor
	HLSW	High pressure switch
	IG1	Ignition coil 1
	IG2	Ignition coil 2
	IG3	Ignition coil 3
	LLSW	Low-pressure switch
	OLP	Engine oil pressure switch
	OVB1	Oil return valve 1
	OVB2	Oil return valve 2
	PSH	High pressure sensor
	STR	Starter
	STM	Throttle valve
	TB1	Terminal block 1 (for power supply)
	TB2	Terminal block 2 (for communication)
	THL	Heat exchanger liquid temperature sensor
	WB	Engine revolution sensor
	WP	Coolant pump
	WT	Coolant sensor
	C/P H	Compressor heater 1 -4 (only for cold district spec.)
	DH	Exhaust air drain heater (only for cold district spec.)
	E/G E	Exhaust air temperature sensor (option)
	E/G WH	Engine oil pan heater (option)
Control box	C1, C2	Condenser for ventilator 1, 2,
	CS	Electrolysis Condenser
	D1, 2, 3	Diode 1,2,3
	DB	Diode bridge
	ELB	Electrical leakage breaker
	FG	Frame ground
	FU1, 2,3	Fuse 1, 2, 3
	IGN	Digital Igniter (controller)
	R1, 2,	Relay 1, 2
	R3	Starter relay
	SUB-PCB	Sub-circuit base board
	TR1	Transformer for Starter
	TR2	Transformer for circuit board
Heat exchanger room	FM1	Electric equipment for ventilator 1
	FM2	Electric equipment for ventilator 2
	THO	Outside temperature sensor
Fuel Box	GV1	Gas electromagnetic valve 1
	GV2	Gas electromagnetic valve 2



Note1: The setting in the diagram indicates stopping state.
Note 2: No color connector is natural

2.4.3 Indoor Unit Wiring Diagram

Ceiling cassette type (4-way blowoff) TKT
TKTP28, 36, 45, 56, 71, 80, 90, 112, 140, 160M5, 71, 140S5



SW9-1	OFF	OFF	ON	ON
SW9-2	OFF	ON	OFF	ON
Lifting Stroke	1.3	1.6	2.0	4.0
Panel	For lifting stroke of 2 m			4 m

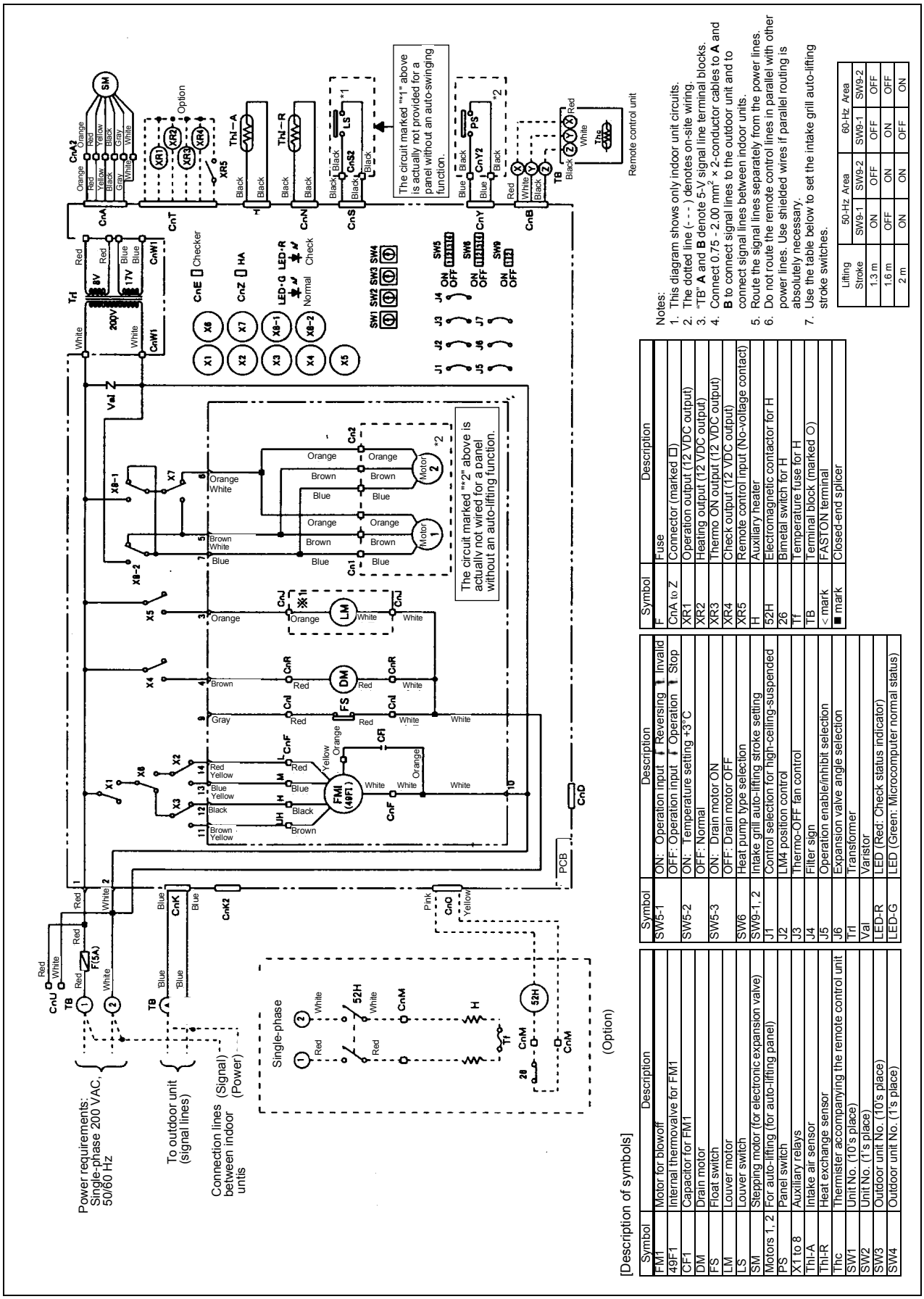
[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49F-1	Internal thermovalve for FM1
CF1	Capacitor for FM1
DM	Drain motor
FS	Float switch
LM	Louver motor
LS	Louver switch
SM	Stepping motor (for electronic expansion valve)
Motors 1, 2	For auto-lifting (for auto-lifting panel)
PS	Panel switch
X1 to 8	Auxiliary relays
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
Thc	Thermister accompanying the remote control unit
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ↱ Reversing ↰ Invalid OFF: Operation input ↱ Operation ↰ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF

Symbol	Description
SW6	Heat pump type selection
SW9-1, 2	Intake grill auto-lifting stroke setting
J1	Control selection for high-ceiling-suspended
J2	LM4 position control
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
26	Bimetal switch for H
Tf	Temperature fuse for H
TB	Terminal block (marked O)
< mark	FASTON terminal

Symbol	Description
I/F	Wireless interface
LED1	Operation indicator
LED2	Check/Timer indicator (yellow)
SW	Backup switch

Ceiling cassette compact type (4-way blowoff): TKTC
TKTCP28, 36, 45, 56M5



Lifting Stroke	50-Hz Area		60-Hz Area	
	SW9-1	SW9-2	SW9-1	SW9-2
1.3 m	ON	OFF	OFF	OFF
1.6 m	OFF	ON	ON	OFF
2 m	ON	ON	OFF	ON

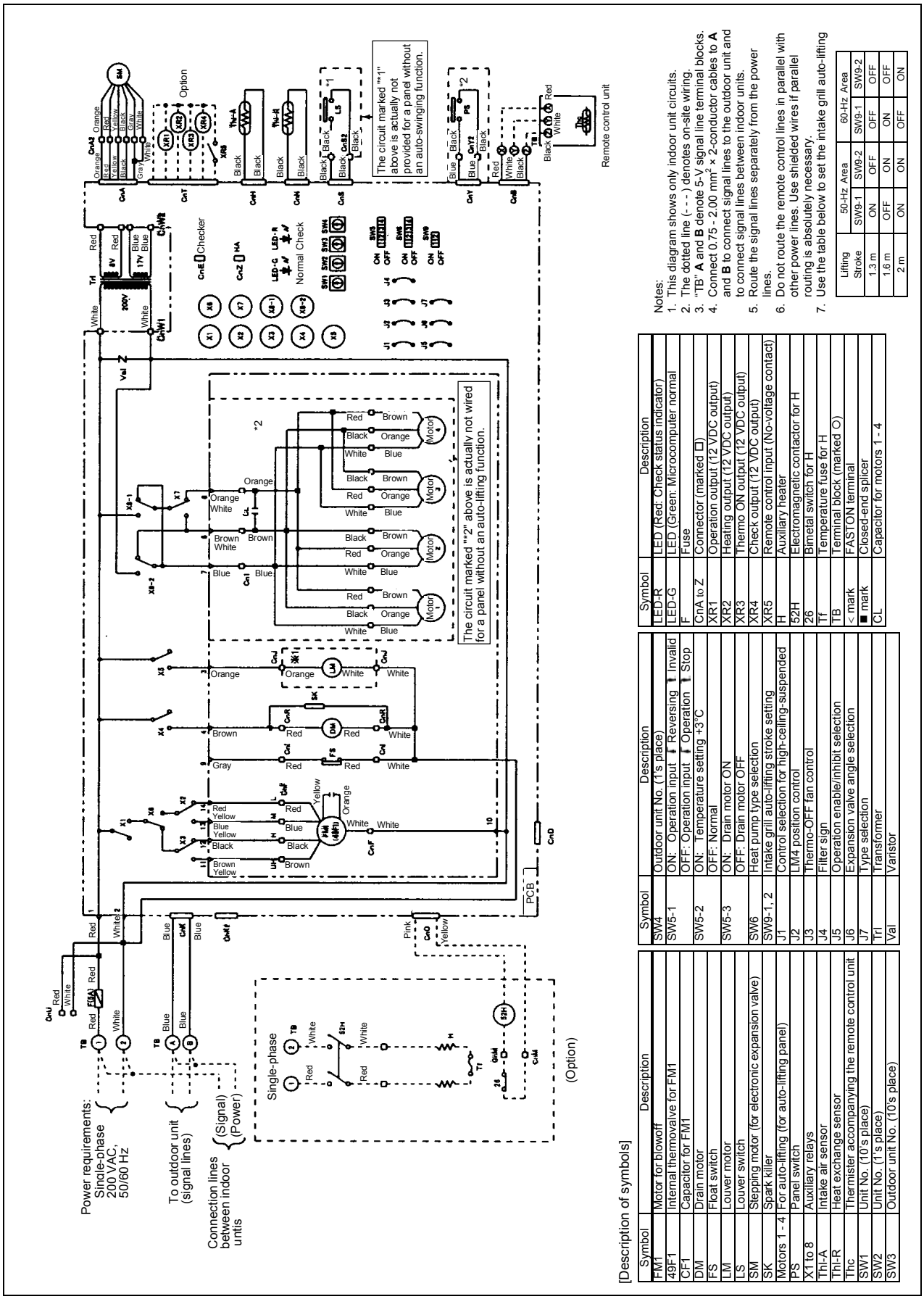
[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49F1	Internal thermovalve for FM1
CF1	Capacitor for FM1
DM	Drain motor
FS	Float switch
LM	Louver motor
LS	Louver switch
SM	Stepping motor (for electronic expansion valve)
Motors 1, 2	For auto-lifting (for auto-lifting panel)
PS	Panel switch
X1 to 8	Auxiliary relays
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
Thc	Thermister accompanying the remote control unit
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)

Symbol	Description
SW5-1	ON: Operation input ⇒ Reversing ⇒ Invalid
	OFF: Operation input ⇒ Operation ⇒ Stop
SW5-2	ON: Temperature setting +3°C
	OFF: Normal
SW5-3	ON: Drain motor ON
	OFF: Drain motor OFF
SW6	Heat pump type selection
SW9-1, 2	Intake grill auto-lifting stroke setting
J1	Control selection for high-ceiling-suspended
J2	LM4 position control
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)

Symbol	Description
F	Fuse
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
26	Bimetal switch for H
Tf	Temperature fuse for H
TB	Terminal block (marked ○)
≤ mark	FASTON terminal
■ mark	Closed-end splicer

Ceiling cassette compact type (2-way blowoff): TKTW
TKTWP22, 28, 36, 45, 56M5



[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49F1	Internal thermovalve for FM1
CF1	Capacitor for FM1
DM	Drain motor
FS	Float switch
LM	Louver motor
LS	Louver switch
SM	Stepping motor (for electronic expansion valve)
SK	Spark killer
Motors 1 - 4	For auto-lifting (for auto-lifting panel)
PS	Panel switch
X1 to 8	Auxiliary relays
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
Thc	Thermister accompanying the remote control unit
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)

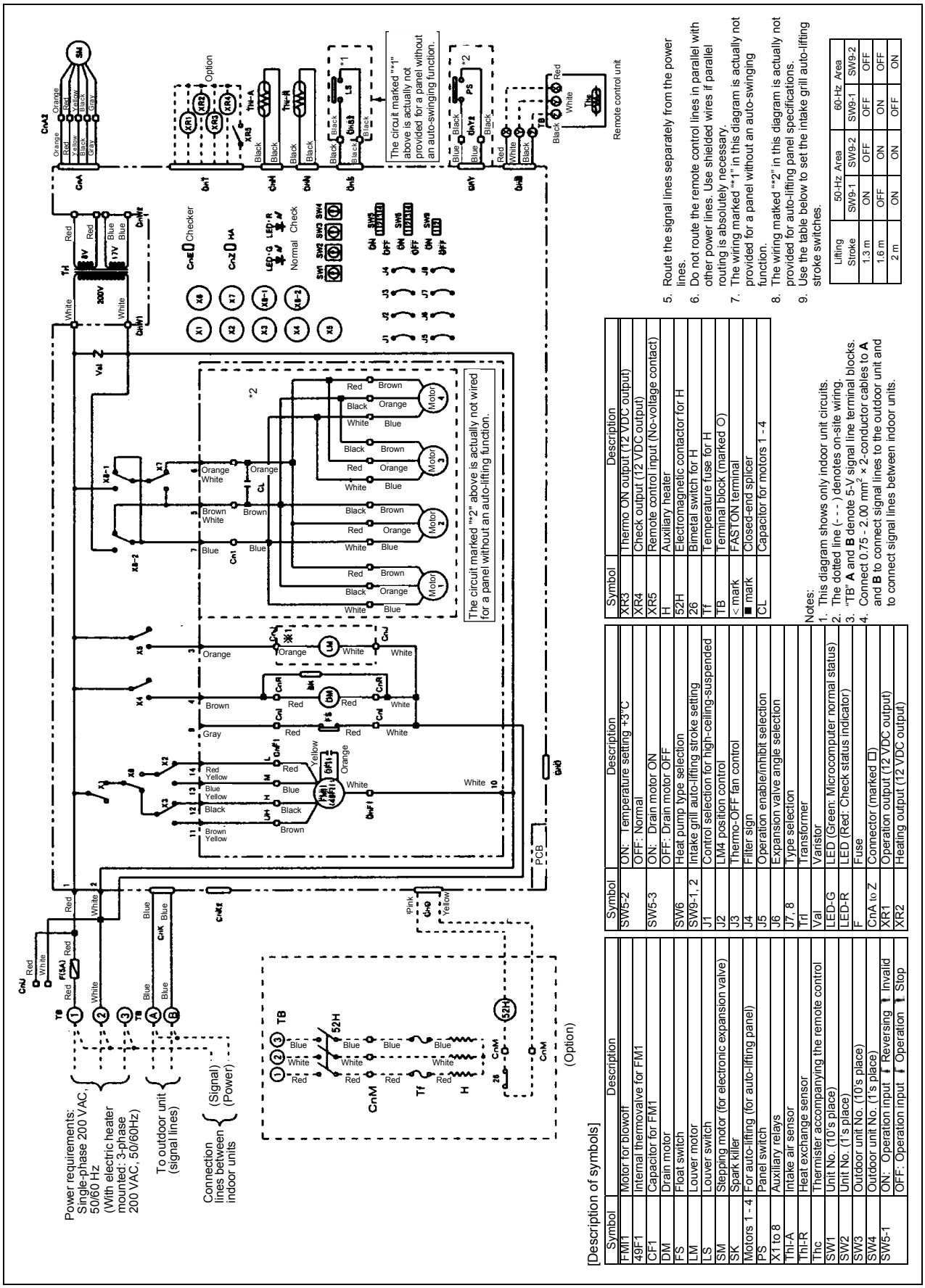
Symbol	Description
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ▮ Reversing ▮ Invalid OFF: Operation input ▮ Operation ▮ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
SW9-1, 2	Intake grill auto-lifting stroke setting
J1	Control selection for high-ceiling-suspended
J2	LM4 position control
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
Tri	Transformer
Val	Varistor

Symbol	Description
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal
F	Fuse
CnA to Z	Connector (marked CD)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
26	Bimetal switch for H
Tf	Temperature fuse for H
TB	Terminal block (marked ○)
< mark	FASTON terminal
■ mark	Closed-end spicer
CL	Capacitor for motors 1 - 4

Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- -) denotes on-site wiring.
3. "TB" **A** and **B** denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to **A** and **B** to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.
7. Use the table below to set the intake grill auto-lifting

Lifting Stroke	50-Hz Area		60-Hz Area	
	SW9-1	SW9-2	SW9-1	SW9-2
1.3 m	ON	OFF	OFF	OFF
1.6 m	OFF	ON	ON	OFF
2 m	ON	ON	OFF	ON

TKTWP71, 80, 90M5 71S5



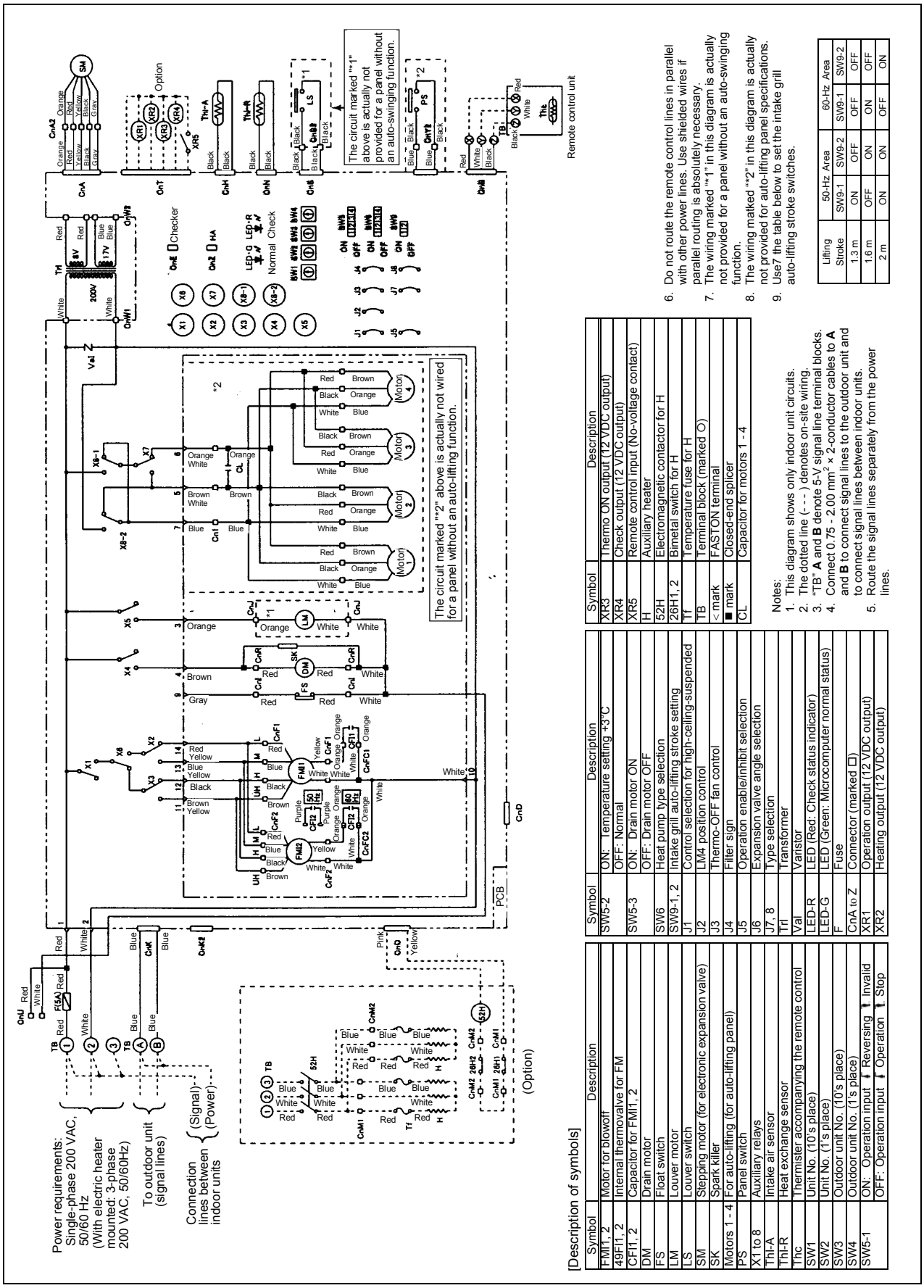
[Description of symbols]

Symbol	Description
FMI1	Motor for blowoff
49F1	Internal thermovalve for FM1
CF1	Capacitor for FM1
DM	Drain motor
FS	Float switch
LM	Louver motor
LS	Louver switch
SM	Stepping motor (for electronic expansion valve)
SK	Spark killer
Motors 1 - 4	For auto-lifting (for auto-lifting panel)
PS	Panel switch
X1 to 8	Auxiliary relays
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
Thc	Thermister accompanying the remote control
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ▮ Reversing ▮ Invalid OFF: Operation input ▮ Operation ▮ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
SW9-1, 2	Intake grill auto-lifting stroke setting
J1	Control selection for high-ceiling-suspended
J2	LM4 position control
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7, 8	Type selection
Trl	Transformer
Val	Varistor
LED-G	LED (Green: Microcomputer normal status)
LED-R	LED (Red: Check status indicator)
F	Fuse
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
26	Bimetal switch for H
Tf	Temperature fuse for H
TB	Terminal block (marked ○)
⏚ mark	FASTON terminal
■ mark	Closed-end splicer
CL	Capacitor for motors 1 - 4

Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" **A** and **B** denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm² × 2-conductor cables to **A** and **B** to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.
7. The wiring marked "*1" in this diagram is actually not provided for a panel without an auto-swinging function.
8. The wiring matked "*2" in this diagram is actually not provided for auto-lifting panel specifications.
9. Use the table below to set the intake grill auto-lifting stroke switches.

Lifting Stroke	50-Hz Area		60-Hz Area	
	SW9-1	SW9-2	SW9-1	SW9-2
1.3 m	ON	OFF	OFF	OFF
1.6 m	OFF	ON	ON	OFF
2 m	ON	ON	OFF	ON

TKTWP112, 140, 160M5, 140S5



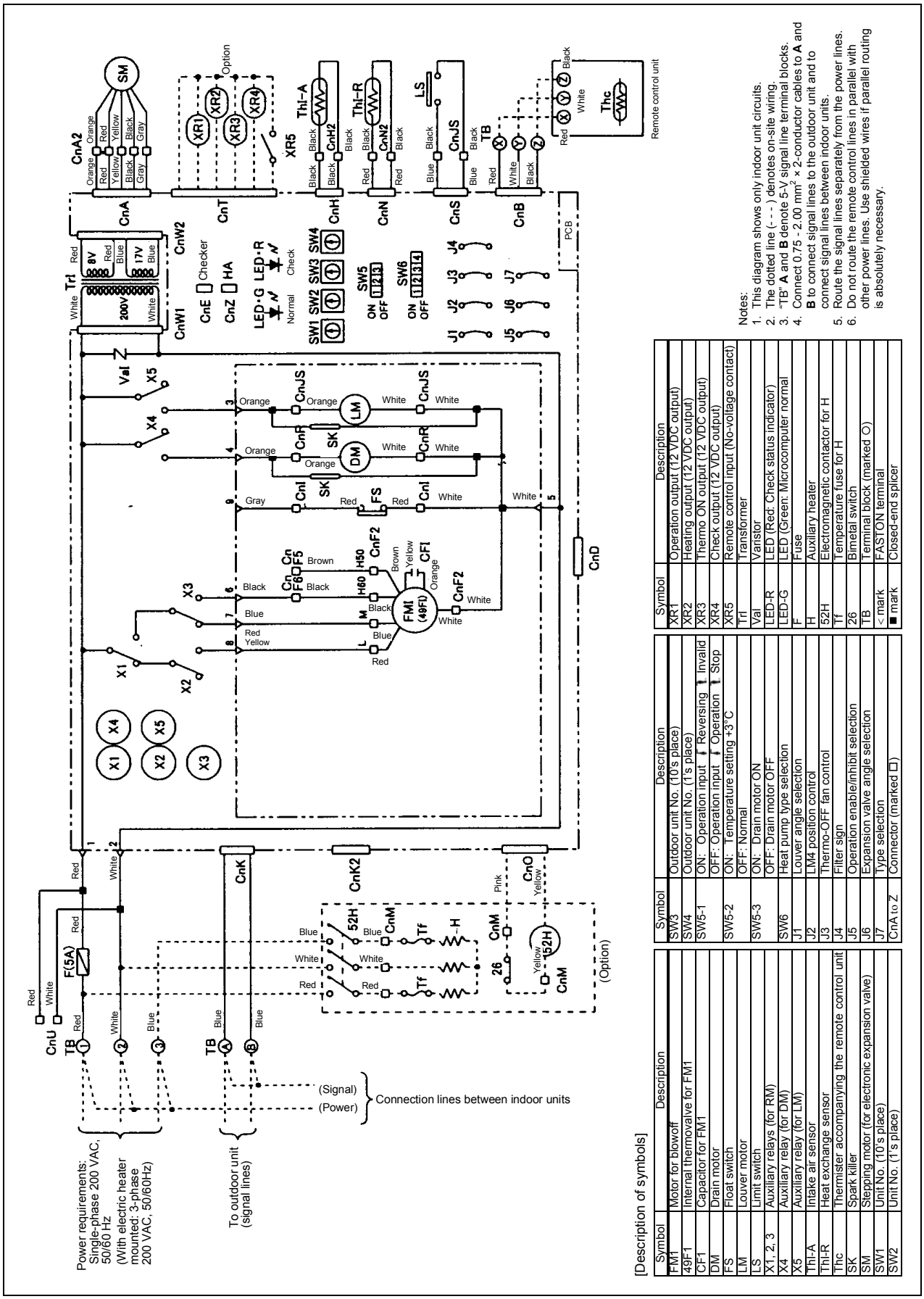
[Description of symbols]

Symbol	Description
FMI1, 2	Motor for blowoff
49FI1, 2	Internal thermovalve for FM
CFI1, 2	Capacitor for FMI1, 2
DM	Drain motor
FS	Float switch
LM	Louver motor
LS	Louver switch
SM	Stepping motor (for electronic expansion valve)
SK	Spark killer
Motors 1 - 4	For auto-lifting (for auto-lifting panel)
PS	Panel switch
X1 to 8	Auxiliary relays
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
Thc	Thermister accompanying the remote control
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ⇓ Reversing ⇓ Invalid OFF: Operation input ⇓ Operation ⇓ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
SW9-1, 2	Intake grill auto-lifting stroke setting
J1	Control selection for high-ceiling-suspended
J2	LM4 position control
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7, 8	Type selection
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
CnA to Z	Connector (marked ⊏)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
26H1, 2	Bimetal switch for H
Tf	Temperature fuse for H
TB	Terminal block (marked O)
< mark	FASTON terminal
■ mark	Closed-end splicer
CL	Capacitor for motors 1 - 4

Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" **A** and **B** denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm² × 2-conductor cables to **A** and **B** to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.
7. The wiring marked "*1" in this diagram is actually not provided for a panel without an auto-swinging function.
8. The wiring matked "*2" in this diagram is actually not provided for auto-lifting panel specifications.
9. Use7 the table below to set the intake grill auto-lifting stroke switches.

Lifting Stroke	50-Hz Area		60-Hz Area	
	SW9-1	SW9-2	SW9-1	SW9-2
1.3 m	ON	OFF	OFF	OFF
1.6 m	OFF	ON	ON	OFF
2 m	ON	ON	OFF	ON

Ceiling cassette type (1-way blowoff): TKTS
TKTSP28, 36, 45, 56M5



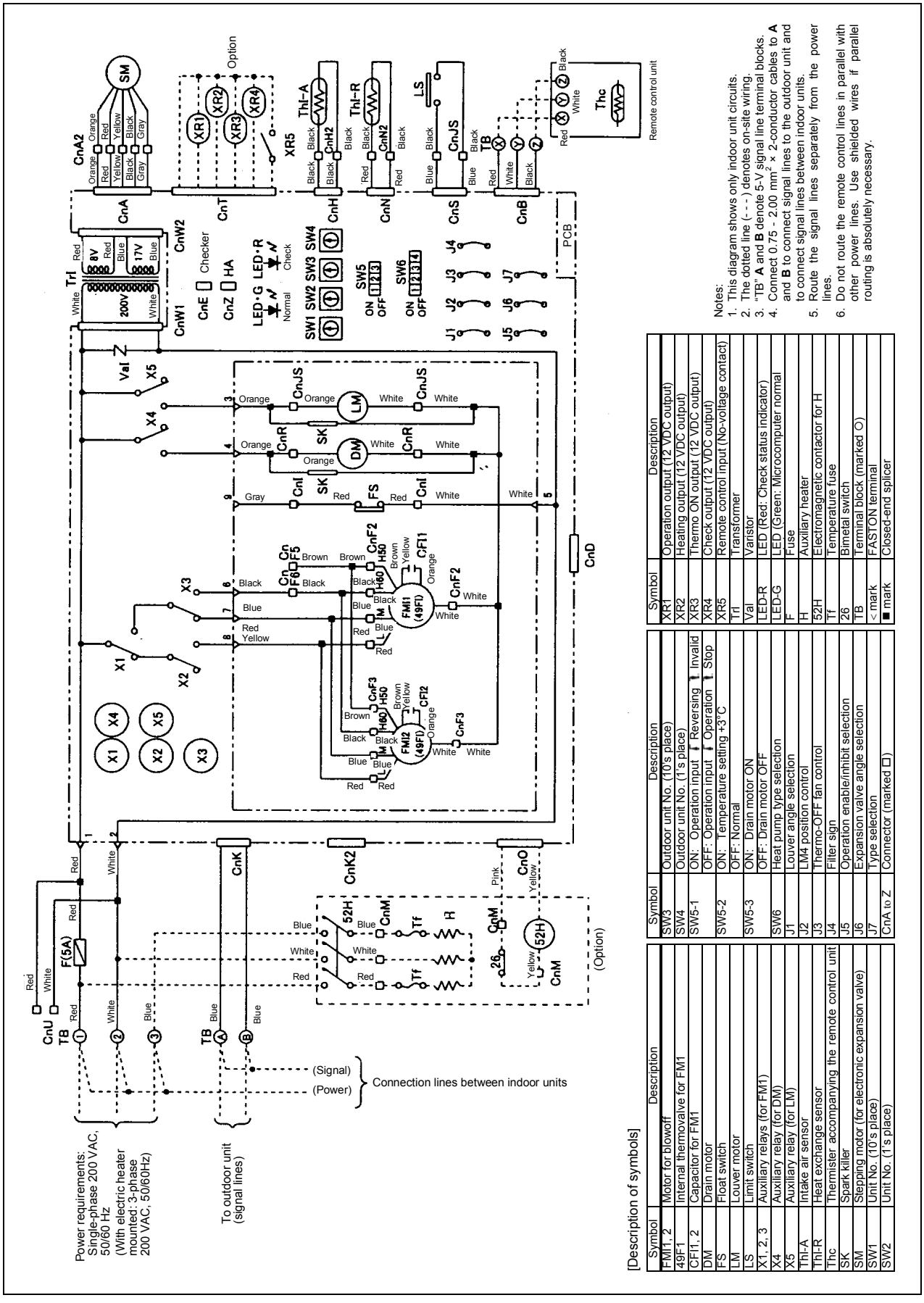
[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49F1	Internal thermovalve for FM1
CF1	Capacitor for FM1
DM	Drain motor
FS	Float switch
LM	Louver motor
LS	Limit switch
X1, 2, 3	Auxiliary relays (for RM)
X4	Auxiliary relay (for DM)
X5	Auxiliary relay (for LM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
Thc	Thermister accompanying the remote control unit
SK	Spark killer
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)

Symbol	Description
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ↓ Reversing 1 Invalid OFF: Operation input ↓ Operation 1 Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J1	Louver angle selection
J2	LM4 position control
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)

Symbol	Description
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal
F	Fuse
H	Auxiliary heater
52H	Electromagnetic contactor for H
Tf	Temperature fuse for H
26	Bimetal switch
TB	Terminal block (marked ○)
< mark	FASTON terminal
■ mark	Closed-end splicer

TKTSP71M5 71S5



[Description of symbols]

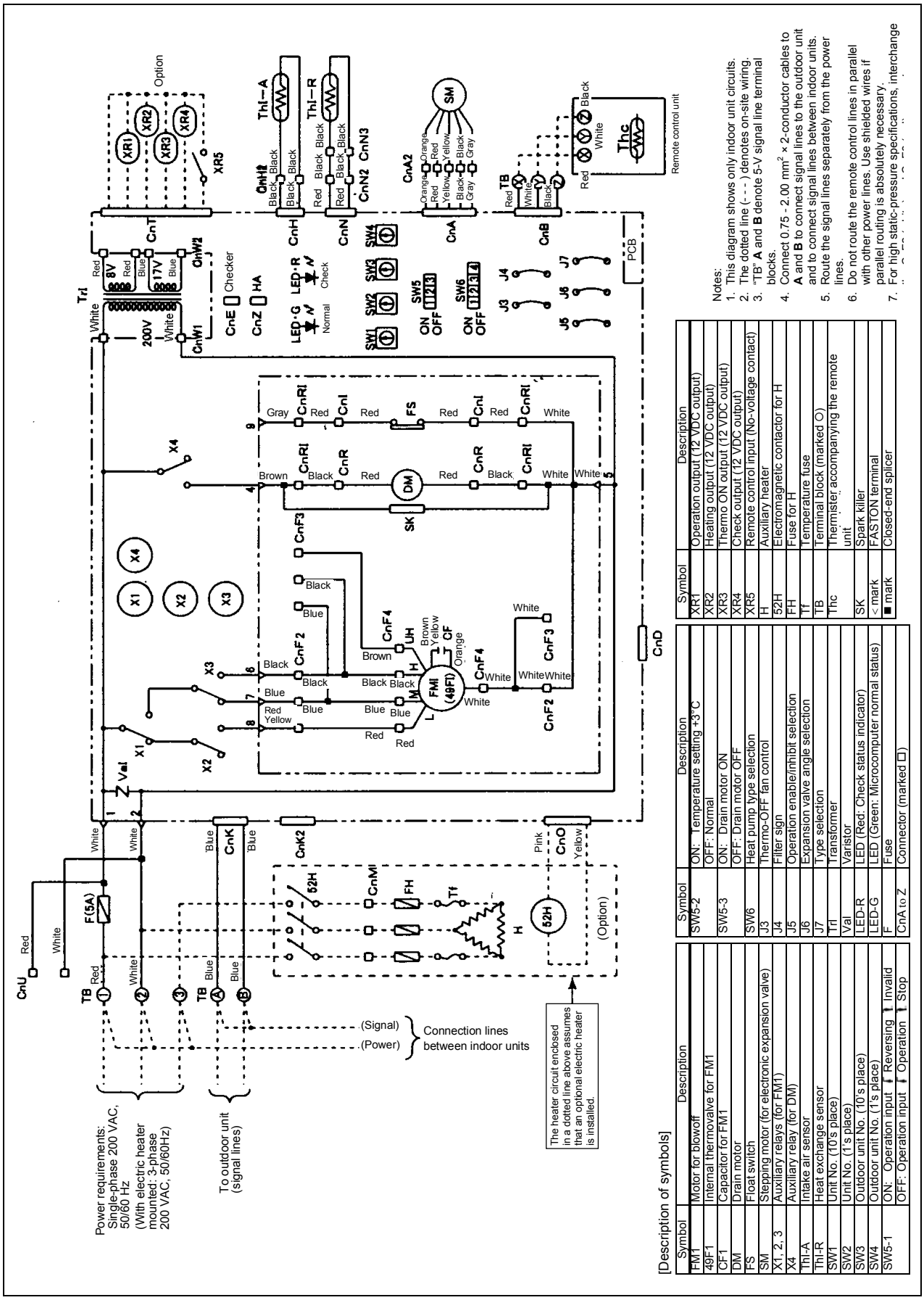
Symbol	Description
FM1, 2	Motor for blowoff
49F1	Internal thermovalve for FM1
CFI1, 2	Capacitor for FM1
DM	Drain motor
FS	Float switch
LM	Louver motor
LS	Limit switch
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for DM)
X5	Auxiliary relay (for LM)
ThI-A	Intake air sensor
ThI-R	Heat exchange sensor
Thc	Thermister accompanying the remote control unit
SK	Spark killer
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)

Symbol	Description
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ↓ Reversing ↑ Invalid OFF: Operation input ↓ Operation ↑ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J1	Louver angle selection
J2	LM4 position control
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)

Symbol	Description
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal
F	Fuse
H	Auxiliary heater
52H	Electromagnetic contactor for H
Tf	Temperature fuse
26	Bimetal switch
TB	Terminal block (marked ○)
< mark	FASTON terminal
■ mark	Closed-end splicer

Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" **A** and **B** denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to **A** and **B** to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.

Built-in type: TKR
TKRP22, 28, 36, 45, 56, 71, 90M5



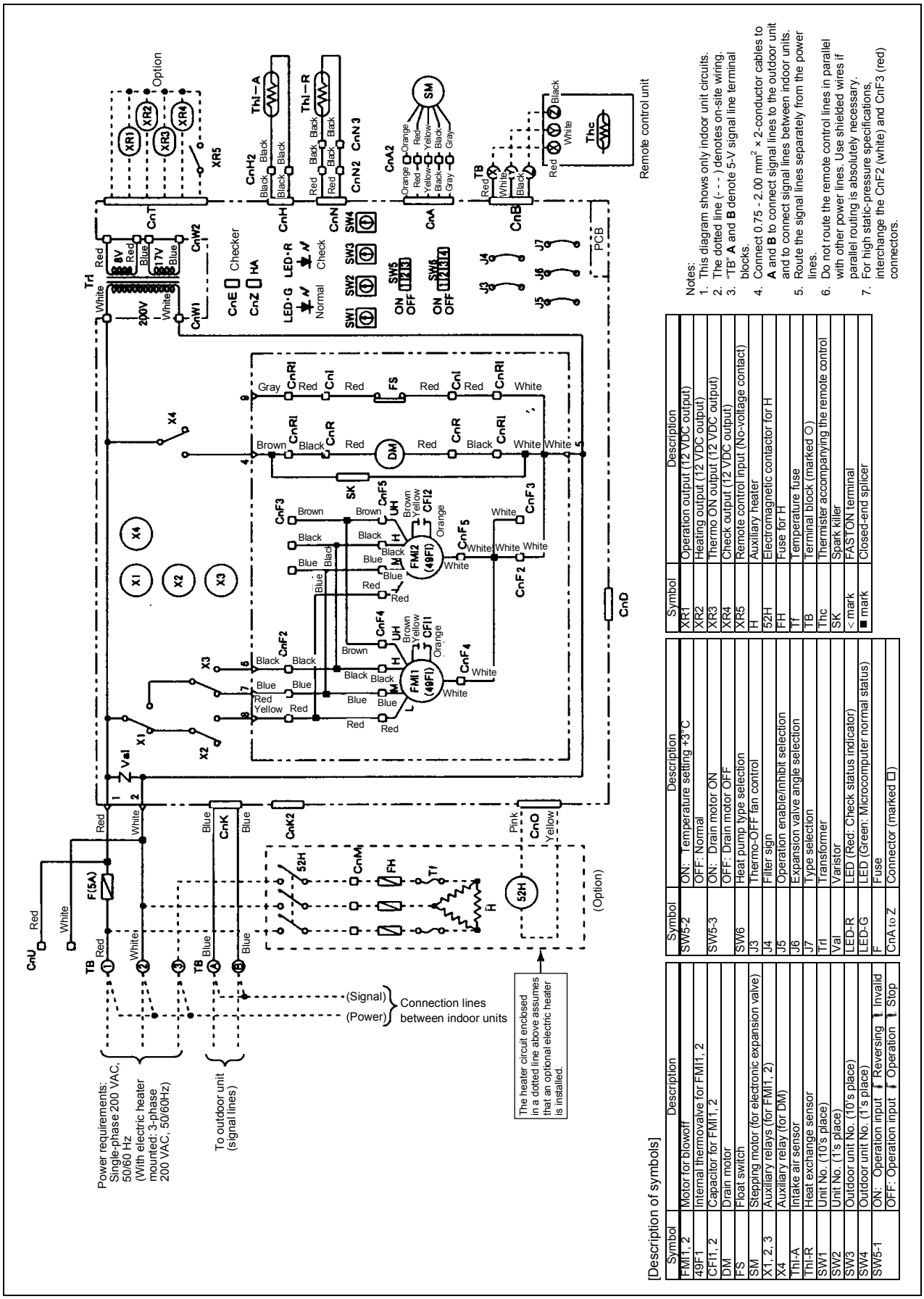
Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" **A** and **B** denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to **A** and **B** to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.
7. For high static-pressure specifications, interchange

[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49F1	Internal thermovalve for FM1
CF1	Capacitor for FM1
DM	Drain motor
FS	Float switch
SM	Stepping motor (for electronic expansion valve)
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for DM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ⬇ Reversing 🡅 Invalid OFF: Operation input ⬇ Operation 🡅 Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
CnA to Z	Connector (marked □)

Symbol	Description
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
FH	Fuse for H
Tf	Temperature fuse
TB	Terminal block (marked O)
Thc	Thermister accompanying the remote unit
SK	Spark killer
⌐ mark	FASTON terminal
■ mark	Closed-end splicer

TKRP112, 140M5 140S5



[Description of symbols]

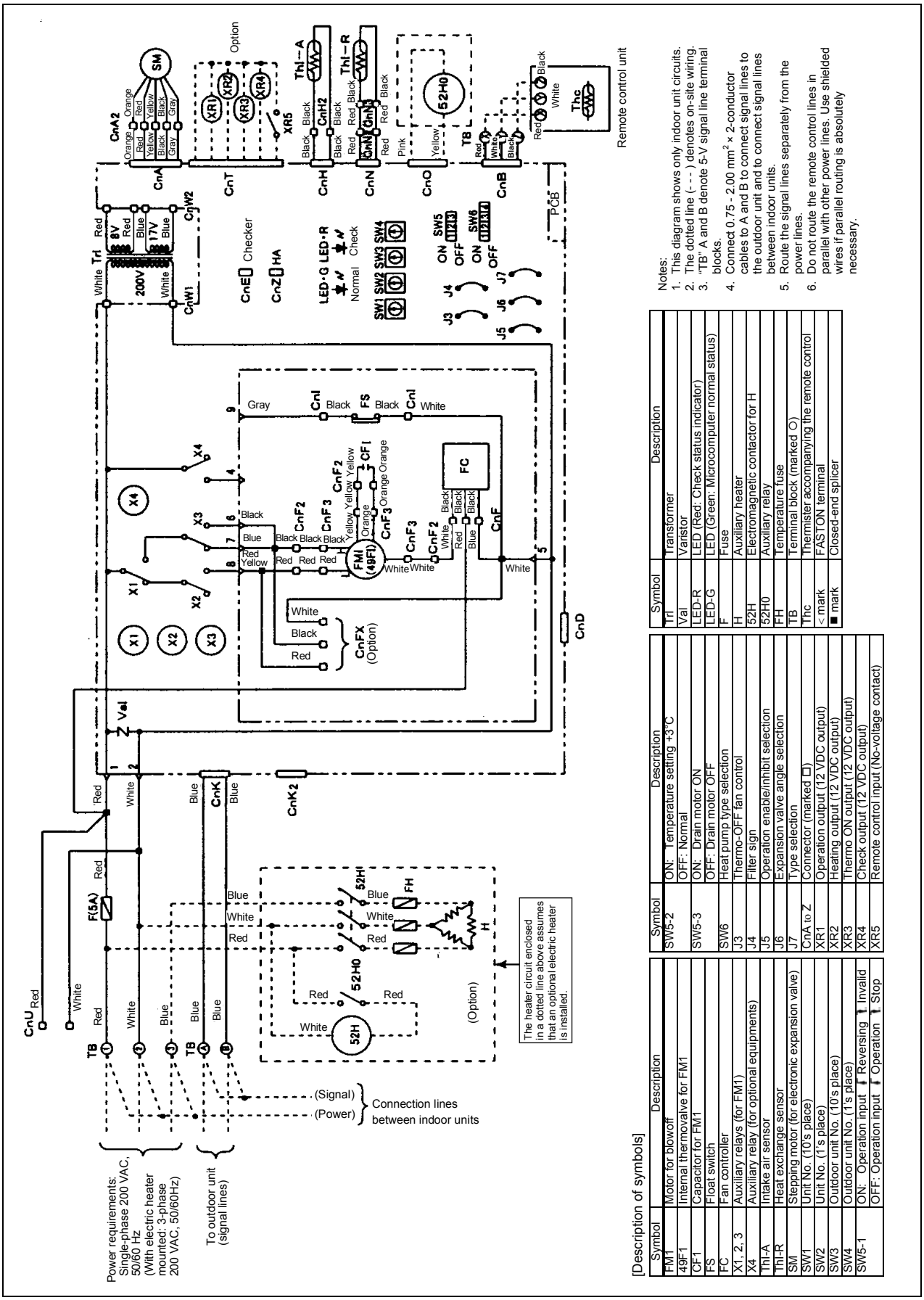
Symbol	Description
FMI1, 2	Motor for blowoff
49F1	Internal thermovalve for FMI1, 2
CFI1, 2	Capacitor for FMI1, 2
DM	Drain motor
FS	Float switch
SM	Stepping motor (for electronic expansion valve)
X1, 2, 3	Auxiliary relays (for FMI1, 2)
X4	Auxiliary relay (for DM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ▮ Reversing ▮ Invalid OFF: Operation input ▮ Operation ▮ Stop

Symbol	Description
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
Tr1	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
CnA to Z	Connector (marked □)

Symbol	Description
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
FH	Fuse for H
Tf	Temperature fuse
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control
SK	Spark killer
< mark	FASTON terminal
■ mark	Closed-end splicer

Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" **A** and **B** denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to **A** and **B** to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.
7. For high static-pressure specifications, interchange the CnF2 (white) and CnF3 (red) connectors.

High static-pressure duct type: TKU
TKUP45, 56, 71, 90, 112, 140M5 140S5



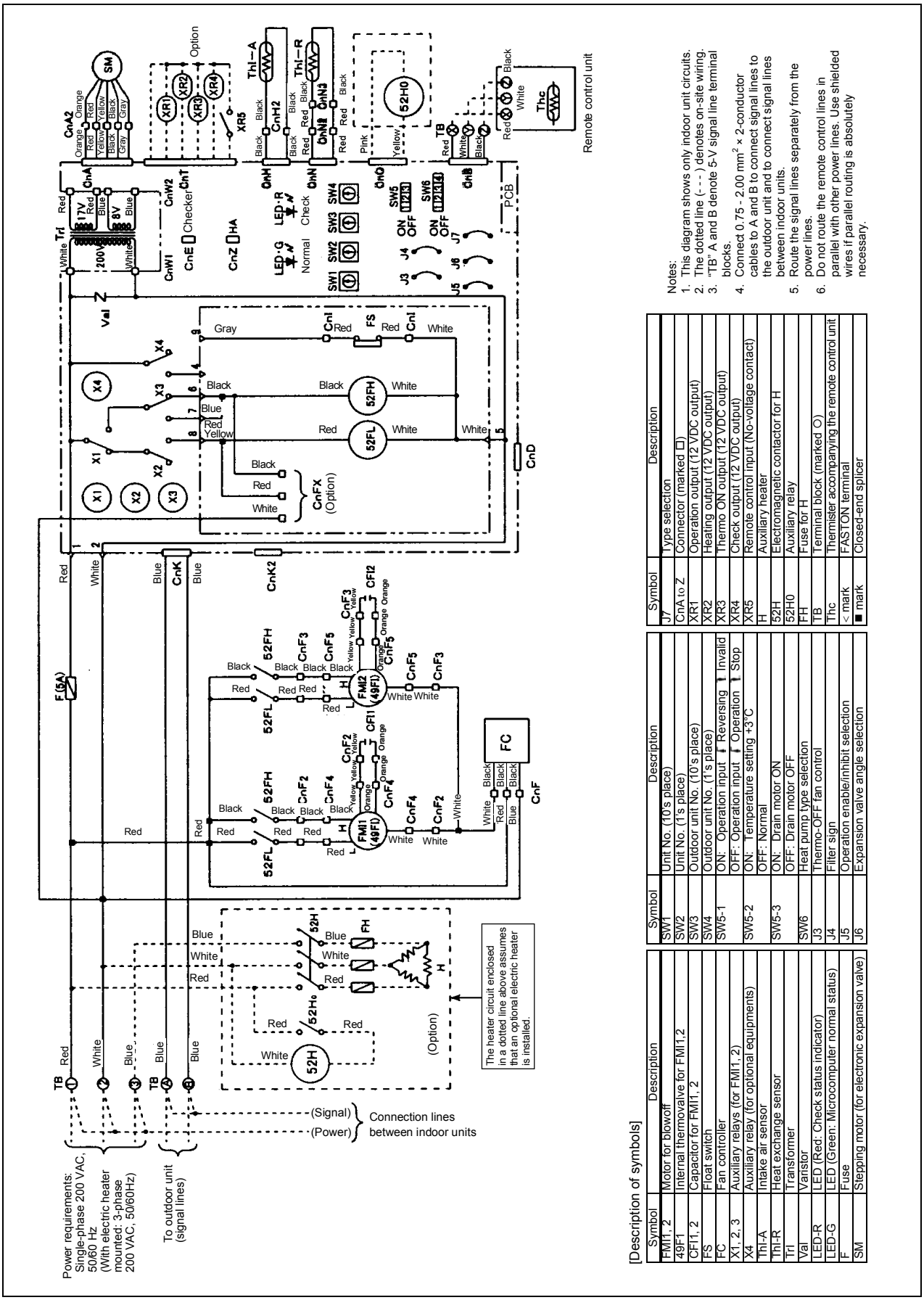
Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" A and B denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to A and B to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.

[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49F1	Internal thermovalve for FM1
CF1	Capacitor for FM1
FS	Float switch
FC	Fan controller
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for optional equipments)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ⇒ Reversing ⇒ Invalid OFF: Operation input ⇒ Operation ⇒ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)

Symbol	Description
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
H	Auxiliary heater
52H	Electromagnetic contactor for H
52H0	Auxiliary relay
FH	Temperature fuse
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control
< mark	FASTON terminal
■ mark	Closed-end splicer

TKUP224M5



Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" A and B denote 5-V signal line terminal blocks.
4. Conned 0.75 - 2.00 mm^2 × 2-conductor cables to A and B to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.

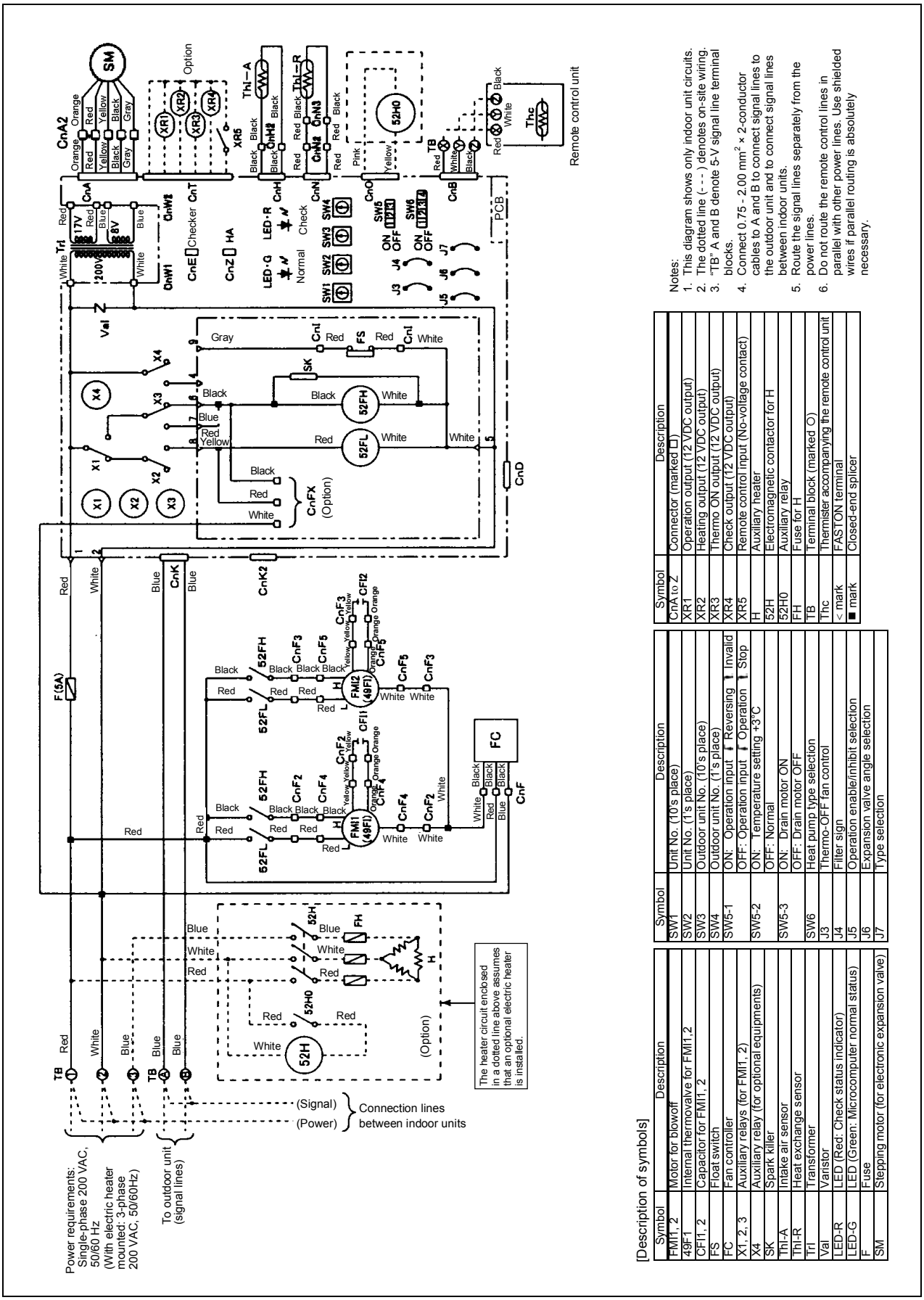
[Description of symbols]

Symbol	Description
FMI1, 2	Motor for blowoff
49F1	Internal thermovalve for FMI1,2
CFI1, 2	Capacitor for FMI1, 2
FS	Float switch
FC	Fan controller
X1, 2, 3	Auxiliary relays (for FMI1, 2)
X4	Auxiliary relay (for optional equipments)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
SM	Stepping motor (for electronic expansion valve)

Symbol	Description
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ⇒ Reversing ⇒ Invalid OFF: Operation input ⇒ Operation ⇒ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection

Symbol	Description
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
52H0	Auxiliary relay
FH	Fuse for H
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control unit
< mark	FASTON terminal
■ mark	Closed-end splicer

TKUP280M5



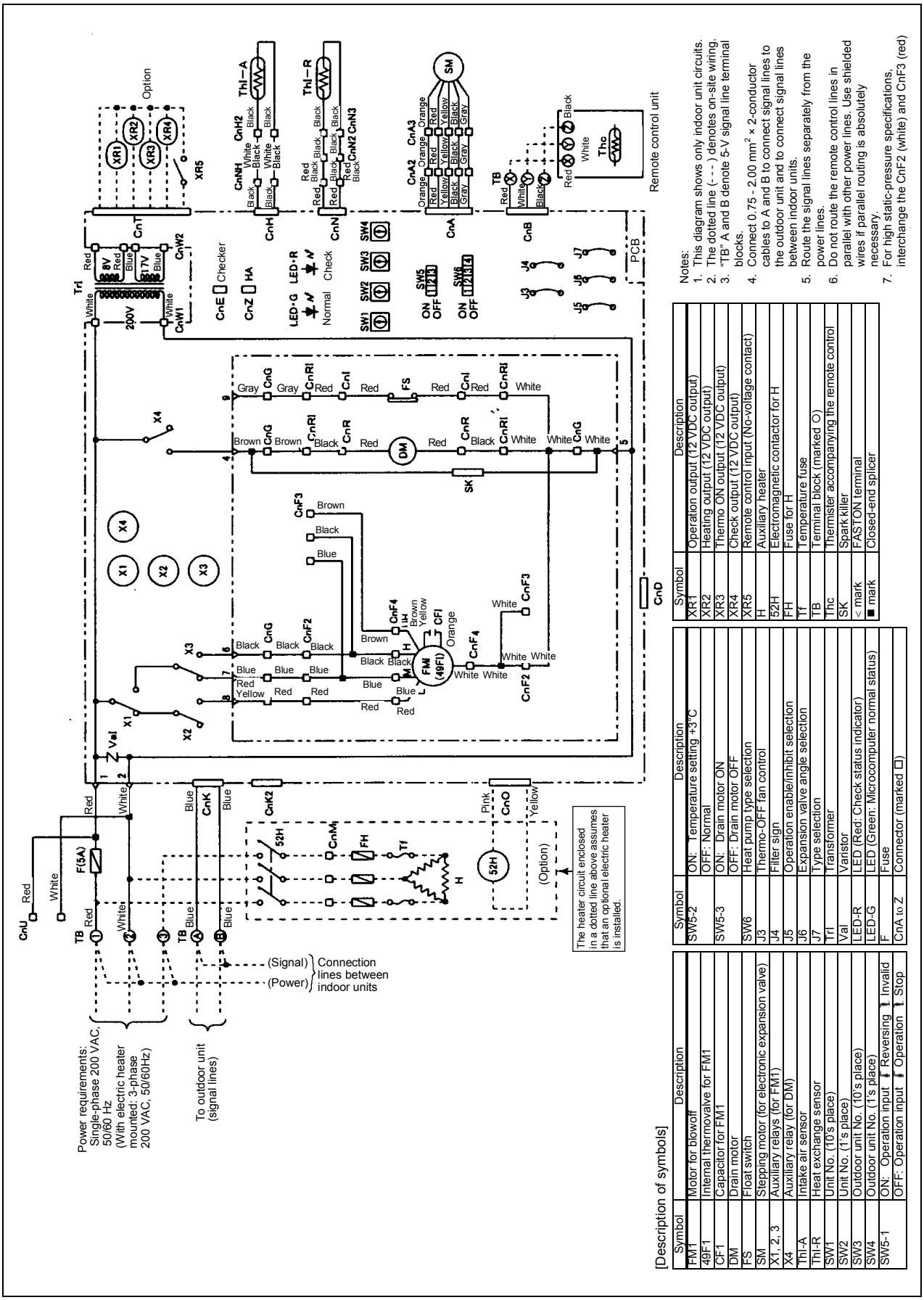
[Description of symbols]

Symbol	Description
FMI1, 2	Motor for blowoff
49F1	Internal thermovalve for FMI1,2
CFI1, 2	Capacitor for FMI1, 2
FS	Float switch
FC	Fan controller
X1, 2, 3	Auxiliary relays (for FMI1, 2)
X4	Auxiliary relay (for optional equipments)
SK	Spark killer
Thi-A	Intake air sensor
Thi-R	Heat exchange sensor
Tri	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
SM	Stepping motor (for electronic expansion valve)

Symbol	Description
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ⇒ Reversing ⇒ Invalid OFF: Operation input ⇒ Operation ⇒ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection

Symbol	Description
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
52H0	Auxiliary relay
FH	Fuse for H
TB	Terminal block (marked O)
Thc	Thermister accompanying the remote control unit
< mark	FASTON terminal
■ mark	Closed-end splicer

Medium static-pressure duct type: TKUM
TKUMP22, 28, 36M5



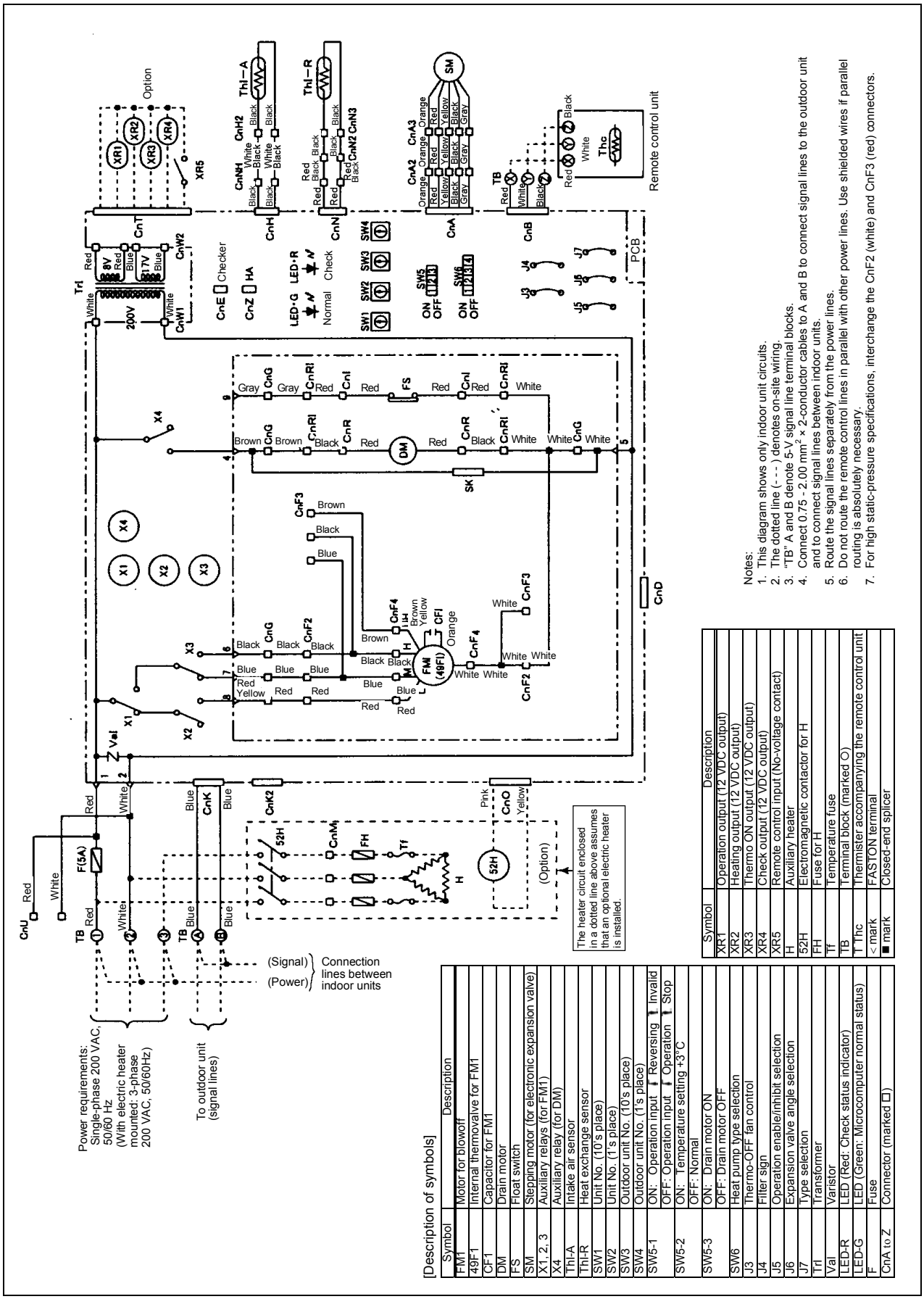
[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49F1	Internal thermovalve for FM1
CF1	Capacitor for FM1
DM	Drain motor
FS	Float switch
SM	Stepping motor (for electronic expansion valve)
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for DM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ⇒ Reversing ⇒ Invalid OFF: Operation input ⇒ Operation ⇒ Stop

Symbol	Description
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
CnA to Z	Connector (marked □)

Symbol	Description
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
FH	Fuse for H
Tf	Temperature fuse
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control
SK	Spark killer
< mark	FASTON terminal
■ mark	Closed-end splicer

TKUMP45, 56, 71, 90M5

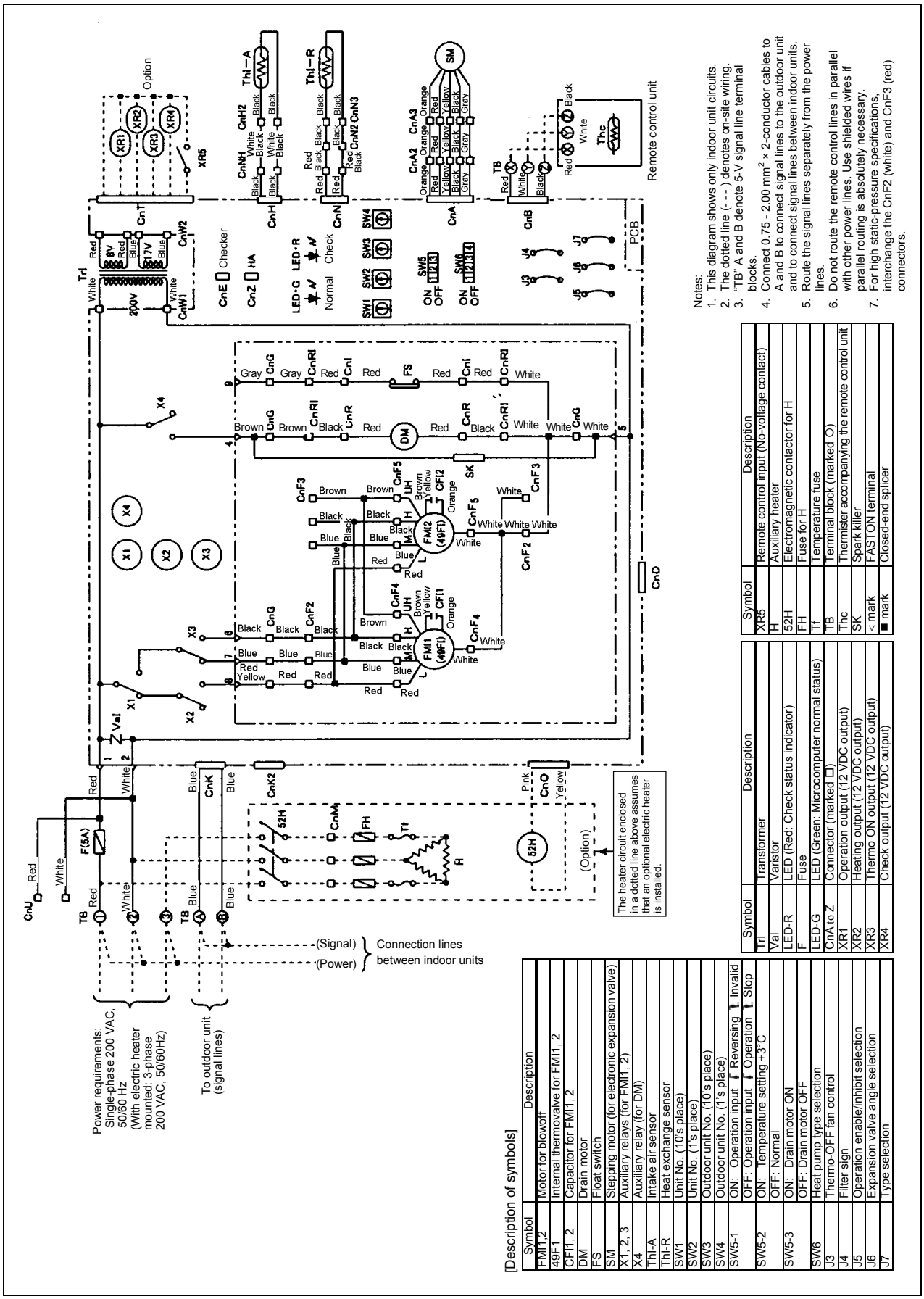


[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49F1	Internal thermovalve for FM1
CF1	Capacitor for FM1
DM	Drain motor
FS	Float switch
SM	Stepping motor (for electronic expansion valve)
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for DM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ↑ Reversing ↓ Invalid OFF: Operation input ↑ Operation ↓ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
Tr1	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
CnA to Z	Connector (marked □)

Symbol	Description
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
FH	Fuse for H
Tf	Temperature fuse
TB	Terminal block (marked ○)
T Thc	Thermister accompanying the remote control unit
< mark	FASTON terminal
■ mark	Closed-end splicer

TKUMP112, 140M5



Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" A and B denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to A and B to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.
7. For high static-pressure specifications, interchange the CnF2 (white) and CnF3 (red) connectors.

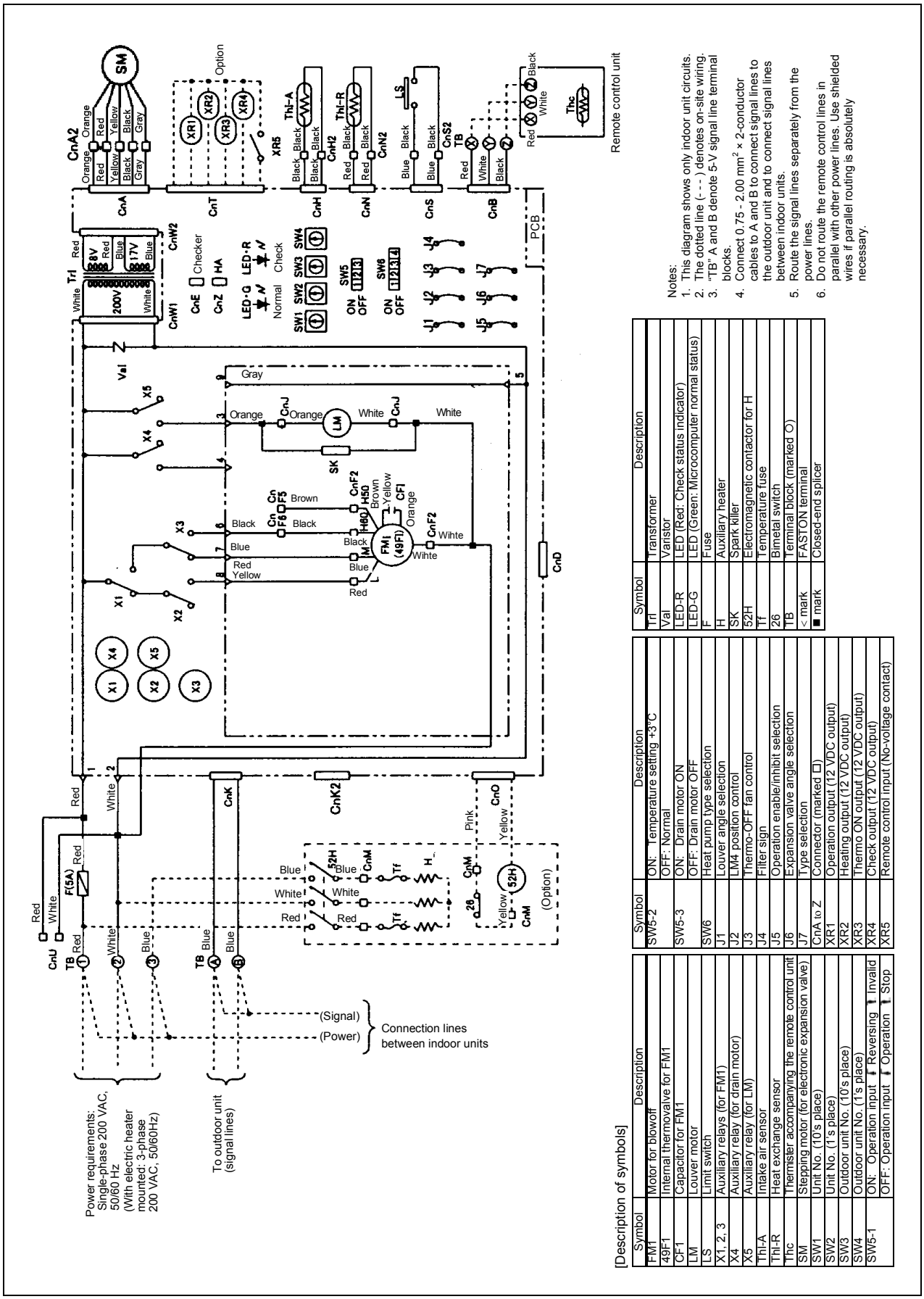
[Description of symbols]

Symbol	Description
FMI1,2	Motor for blowoff
49F1	Internal thermovalve for FMI1, 2
CFI1, 2	Capacitor for FMI1, 2
DM	Drain motor
FS	Float switch
SM	Stepping motor (for electronic expansion valve)
X1, 2, 3	Auxiliary relays (for FMI1, 2)
X4	Auxiliary relay (for DM)
Thi-A	Intake air sensor
Thi-R	Heat exchange sensor
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ↓ Reversing ↑ Invalid OFF: Operation input ↓ Operation ↑ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection

Symbol	Description
Tri	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
F	Fuse
LED-G	LED (Green: Microcomputer normal status)
CnA to Z	Connector (marked CI)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)

Symbol	Description
XR5	Remote control input (No-voltage contact)
H	Auxiliary heater
52H	Electromagnetic contactor for H
FH	Fuse for H
Tf	Temperature fuse
TB	Terminal block (marked O)
Thc	Thermister accompanying the remote control unit
SK	Spark killer
< mark	FASTON terminal
■ mark	Closed-end splicer

Ceiling-suspended type: TKE
TKEP36, 45, 56M5



Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" A and B denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to A and B to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.

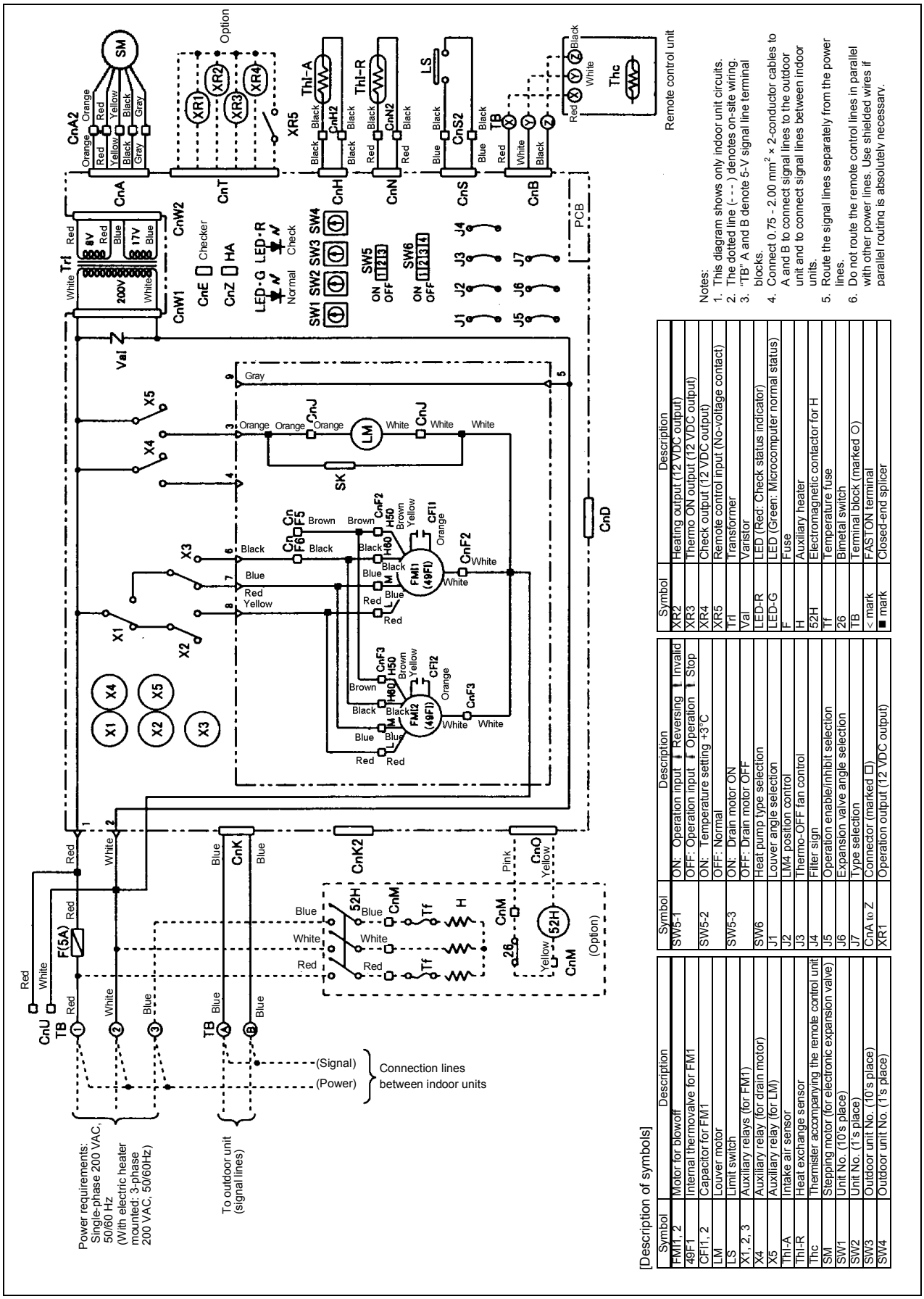
[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49F1	Internal thermovalve for FM1
CF1	Capacitor for FM1
LM	Louver motor
LS	Limit switch
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for drain motor)
X5	Auxiliary relay (for LM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
Thc	Thermister accompanying the remote control unit
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ↓ Reversing ↑ Invalid OFF: Operation input ↓ Operation ↑ Stop

Symbol	Description
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J1	Louver angle selection
J2	LM4 position control
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)

Symbol	Description
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
H	Auxiliary heater
SK	Spark killer
52H	Electromagnetic contactor for H
Tf	Temperature fuse
26	Bimetal switch
TB	Terminal block (marked O)
< mark	FASTON terminal
■ mark	Closed-end splicer

TKEP71, 90M5, 71S5



[Description of symbols]

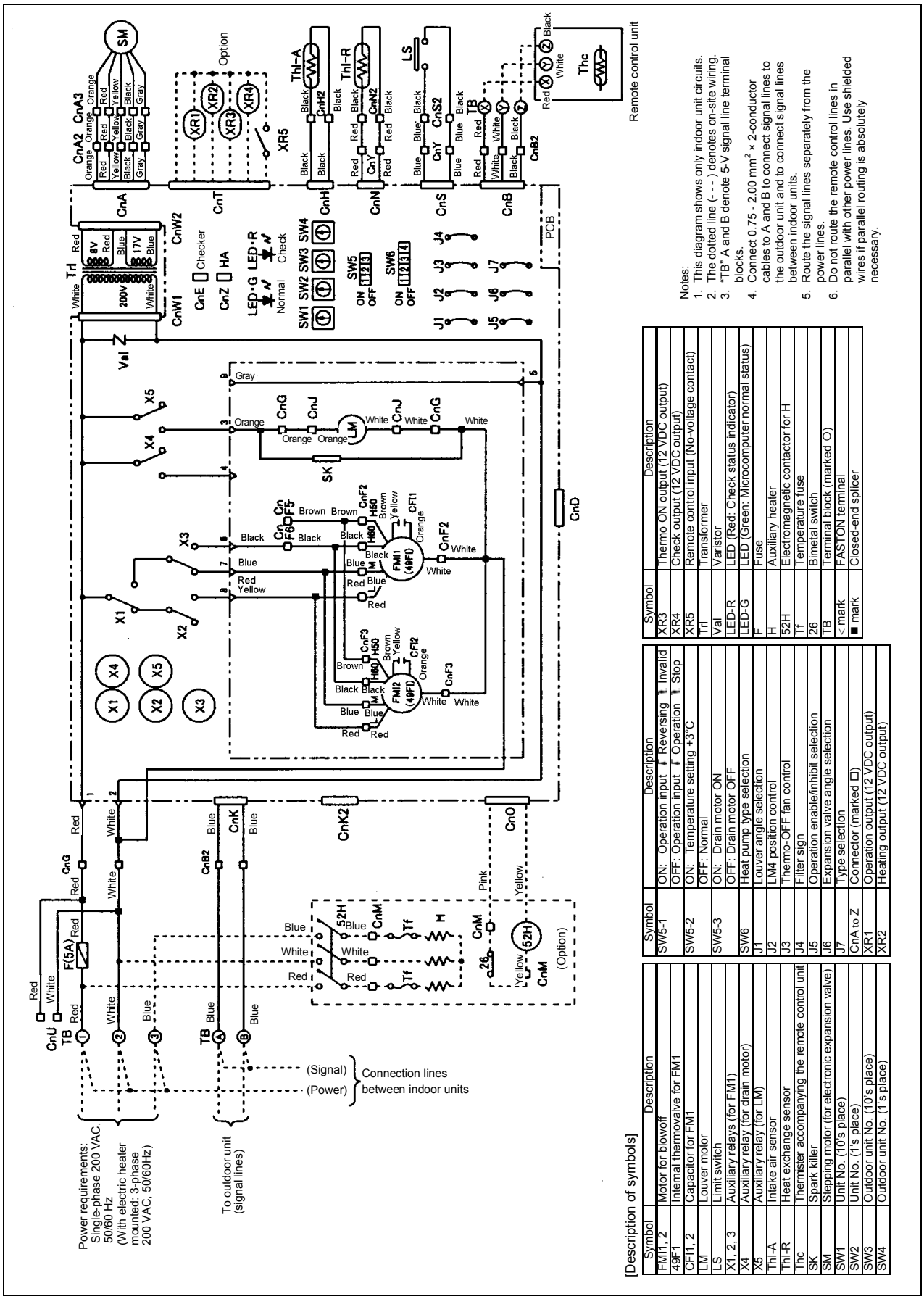
Symbol	Description
FM1, 2	Motor for blowoff
49F-1	Internal thermovalve for FM1
CF1, 2	Capacitor for FM1
LM	Louver motor
LS	Limit switch
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for drain motor)
X5	Auxiliary relay (for LM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
Thc	Thermister accompanying the remote control unit
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)

Symbol	Description
SW5-1	ON: Operation input ↓ Reversing ↑ Invalid
	OFF: Operation input ↓ Operation ↑ Stop
SW5-2	ON: Temperature setting +3°C
	OFF: Normal
SW5-3	ON: Drain motor ON
	OFF: Drain motor OFF
SW6	Heat pump type selection
J1	Louver angle selection
J2	LM4 position control
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)

Symbol	Description
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
H	Auxiliary heater
52H	Electromagnetic contactor for H
Tf	Temperature fuse
26	Bimetal switch
TB	Terminal block (marked ○)
< mark	FASTON terminal
■ mark	Closed-end splicer

Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" A and B denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to A and B to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.

TK EP112, 140M5 140S5



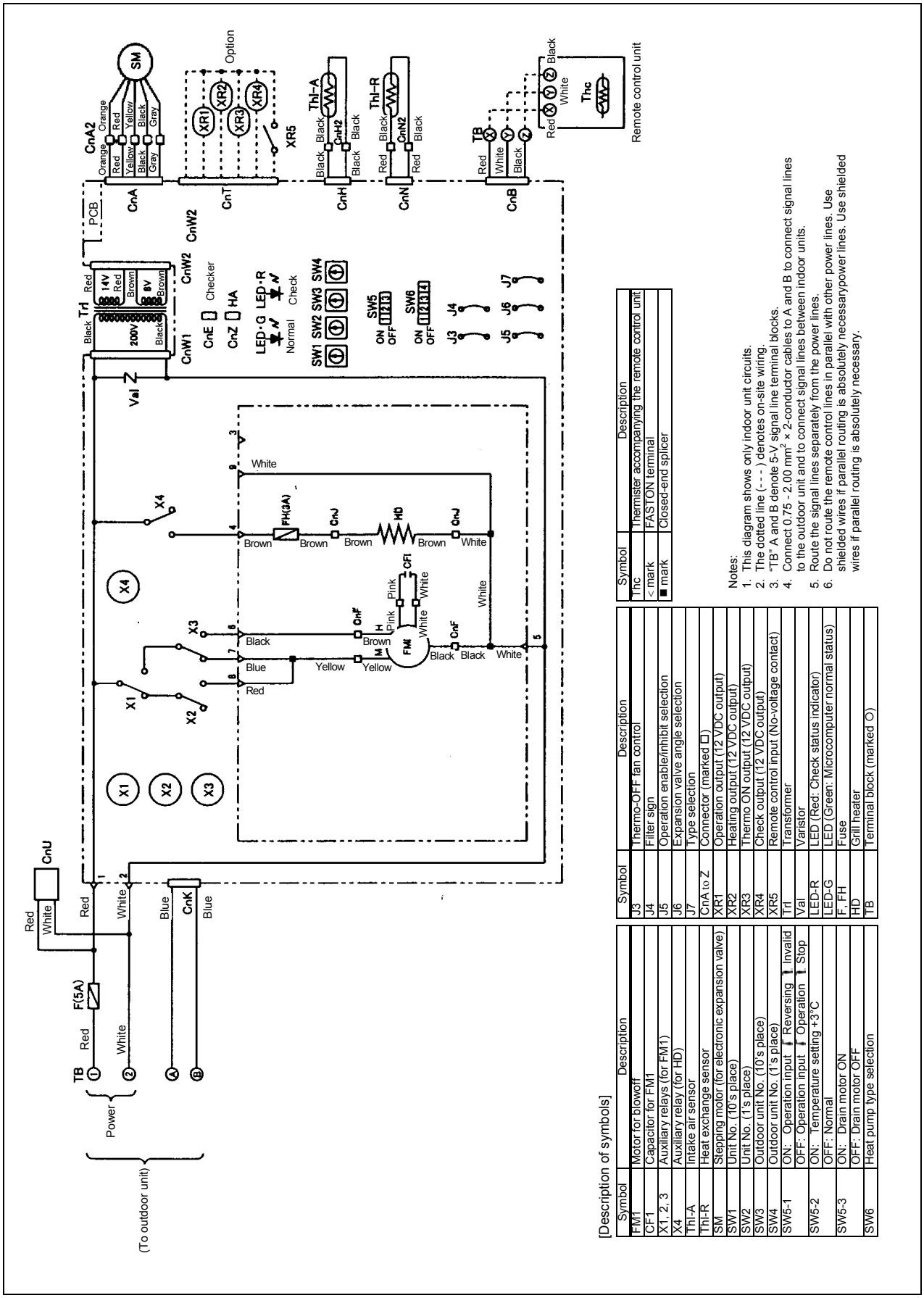
[Description of symbols]

Symbol	Description
FM1, 2	Motor for blowoff
49F1	Internal thermovalve for FM1
CFI1, 2	Capacitor for FM1
LM	Louver motor
LS	Limit switch
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for drain motor)
X5	Auxiliary relay (for LM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
Thc	Thermister accompanying the remote control unit
SK	Spark killer
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)

Symbol	Description
SW5-1	ON: Operation input ↓ Reversing ↑ Invalid OFF: Operation input ↓ Operation ↑ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J1	Louver angle selection
J2	LM4 position control
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)

Symbol	Description
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
H	Auxiliary heater
52H	Electromagnetic contactor for H
Tf	Temperature fuse
26	Bimetal switch
TB	Terminal block (marked ○)
< mark	FASTON terminal
■ mark	Closed-end splicer

Ceiling-suspended oil-resisting type: TKES
TKESP80M5



[Description of symbols]

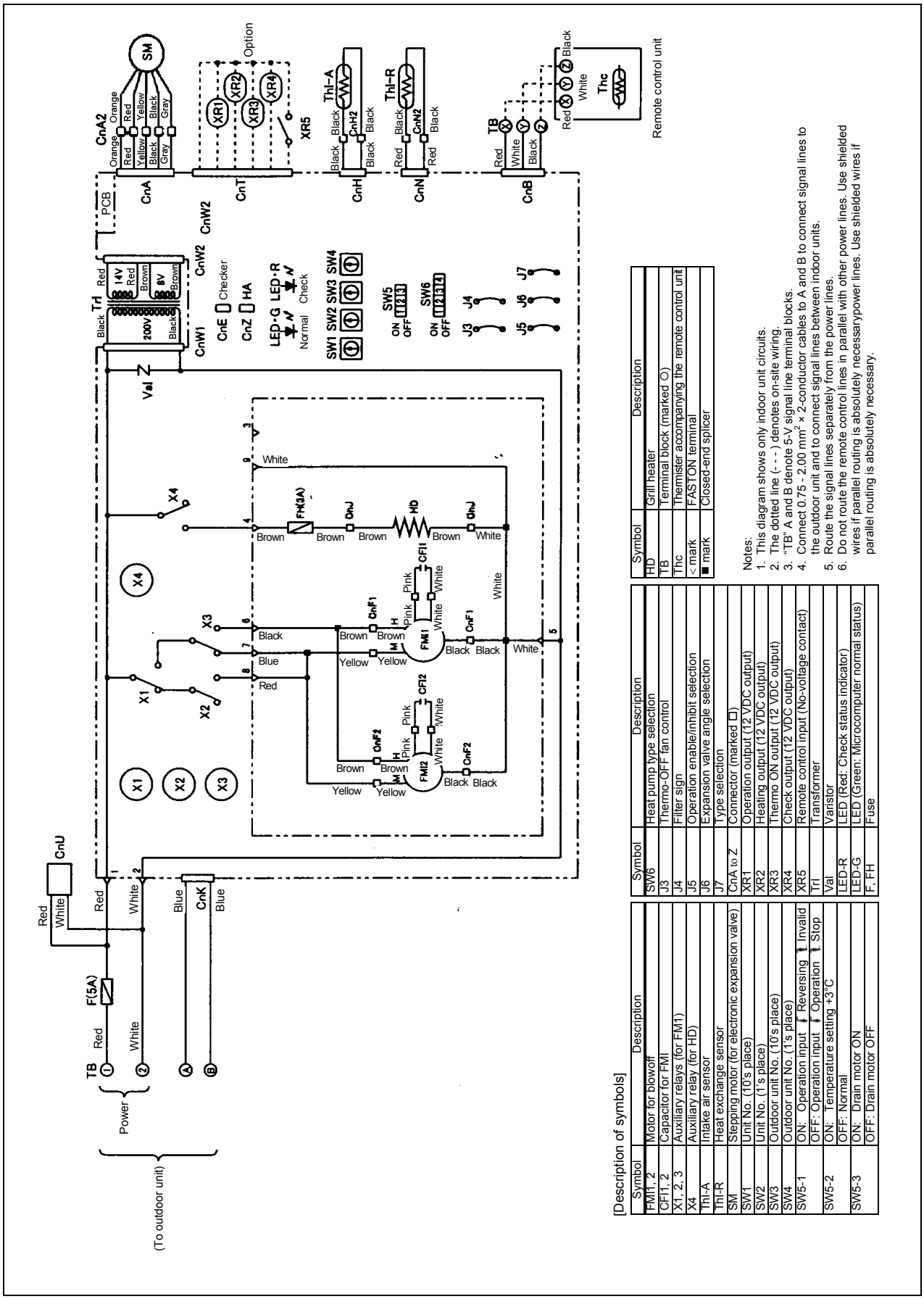
Symbol	Description
FM1	Motor for blowoff
CF1	Capacitor for FM1
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for HD)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ▮ Reversing ▯ Invalid OFF: Operation input ▮ Operation ▯ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection

Symbol	Description
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
Tr1	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F_FH	Fuse
HD	Grill heater
TB	Terminal block (marked ○)

Symbol	Description
Thc	Thermister accompanying the remote control unit
< mark	FASTON terminal
■ mark	Closed-end splicer

Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" A and B denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to A and B to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessarypower lines. Use shielded wires if parallel routing is absolutely necessary.

TKESP140M5 140S5



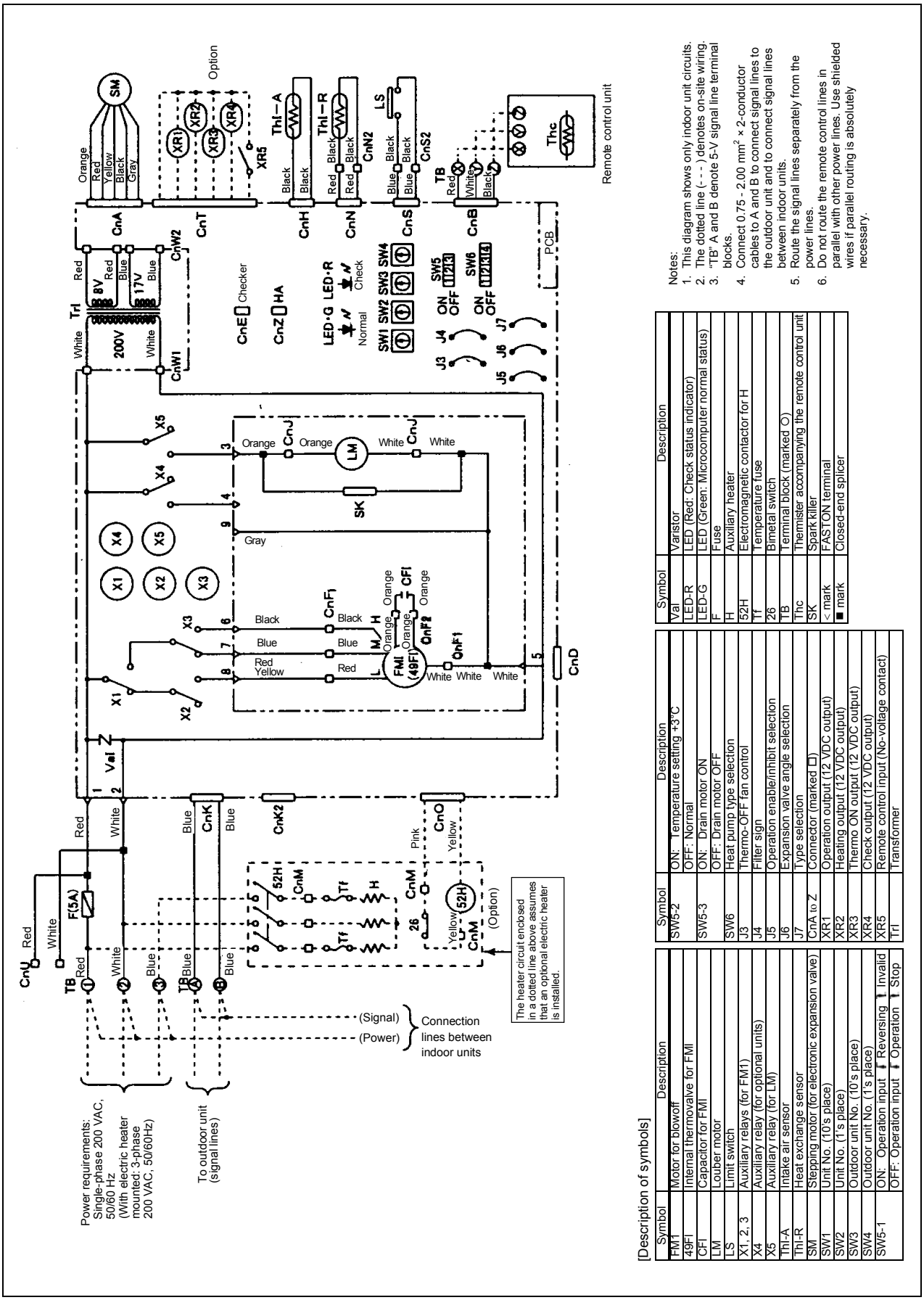
[Description of symbols]

Symbol	Description
FMI1, 2	Motor for blowoff
CFI1, 2	Capacitor for FMI
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for HD)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ↑ Reversing ↓ Invalid OFF: Operation input ↑ Operation ↓ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF

Symbol	Description
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F, FH	Fuse

Symbol	Description
HD	Grill heater
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control unit
< mark	FASTON terminal
■ mark	Closed-end splicer

Wall-mounted type: TKK
TKKP28, 36, 45, 71M5

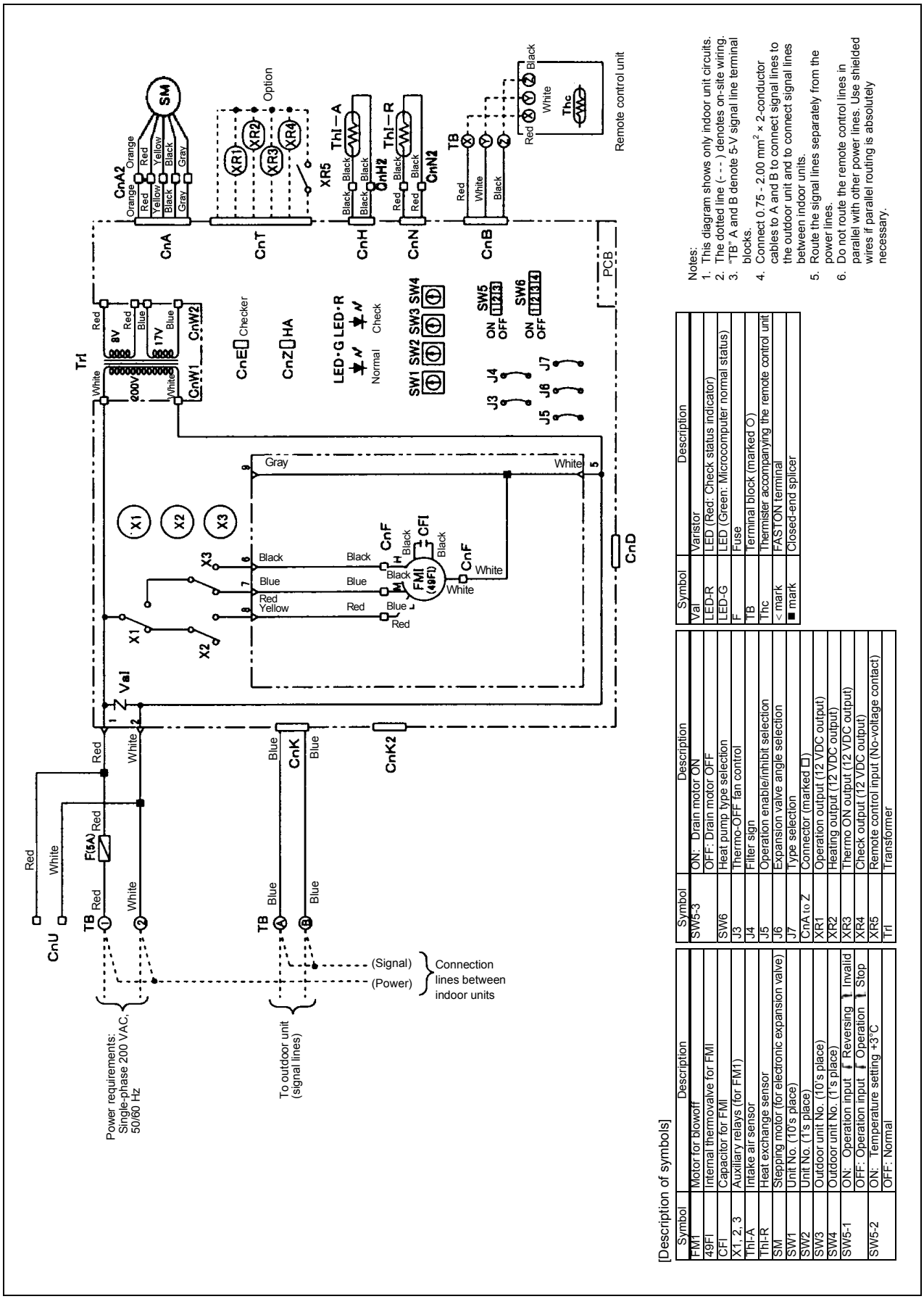


[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49FI	Internal thermovalve for FMI
CFI	Capacitor for FMI
LM	Louber motor
LS	Limit switch
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for optional units)
X5	Auxiliary relay (for LM)
ThI-A	Intake air sensor
ThI-R	Heat exchange sensor
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ⇒ Reversing ⇒ Invalid OFF: Operation input ⇒ Operation ⇒ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Drain motor ON OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
Tri	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
H	Auxiliary heater
52H	Electromagnetic contactor for H
Tf	Temperature fuse
26	Bimetal switch
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control unit
SK	Spark killer
< mark	FASTON terminal
■ mark	Closed-end splicer

Floor-standing lowboy: TKFL
TKFLP28, 45, 56, 71M5

Floor-standing lowboy (concealed type): FKFU
TKFUP28, 45, 56, 71M5



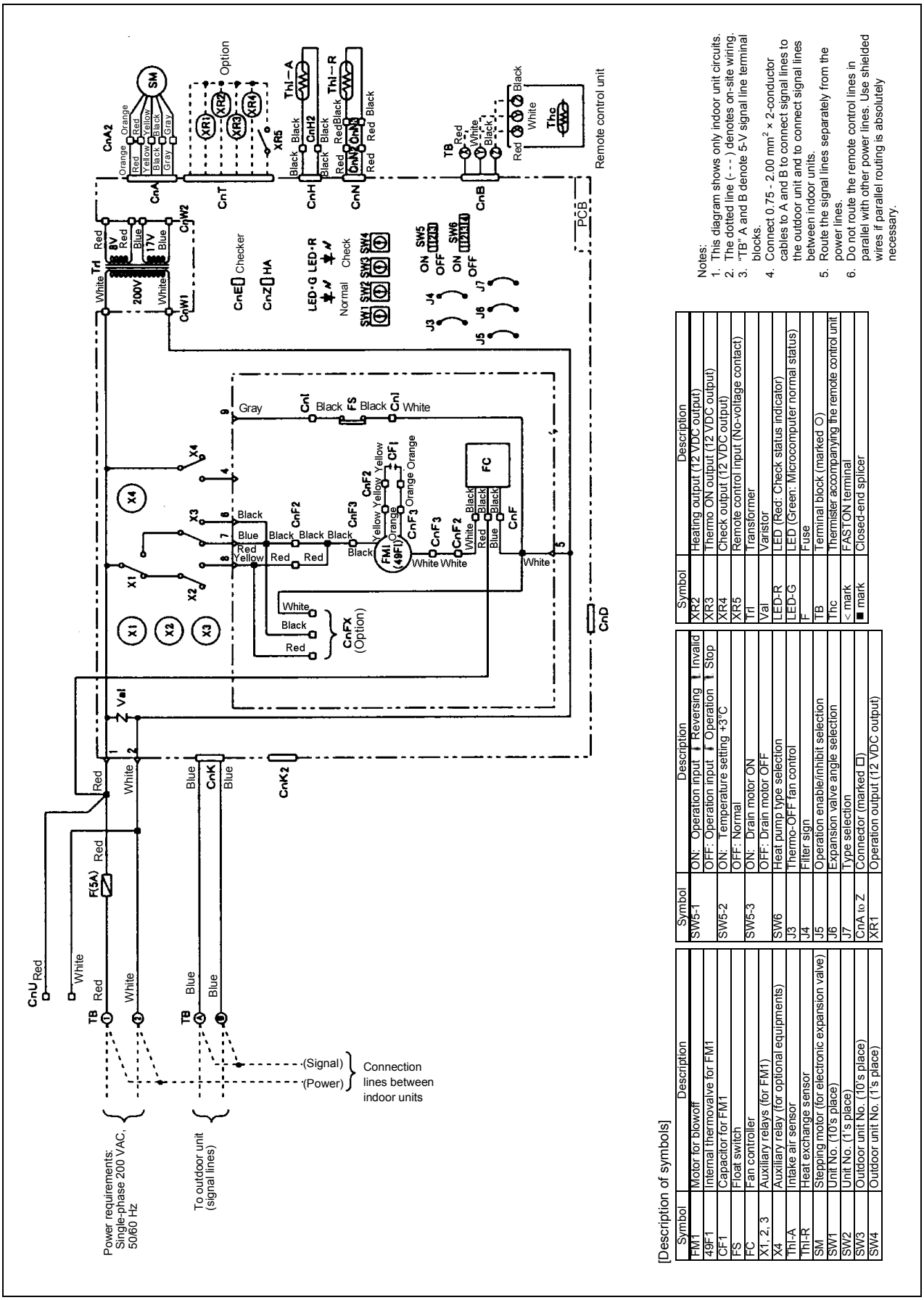
[Description of symbols]

Symbol	Description
FM1	Motor for blowoff
49FI	Internal thermovalve for FMI
CFI	Capacitor for FMI
X1, 2, 3	Auxiliary relays (for FM1)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ⇒ Reversing ⇒ Invalid OFF: Operation input ⇒ Operation ⇒ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal

Symbol		Description
SW5-3	ON:	Drain motor ON
	OFF:	Drain motor OFF
SW6		Heat pump type selection
J3		Thermo-OFF fan control
J4		Filter sign
J5		Operation enable/inhibit selection
J6		Expansion valve angle selection
J7		Type selection
CnA to Z		Connector (marked □)
XR1		Operation output (12 VDC output)
XR2		Heating output (12 VDC output)
XR3		Thermo ON output (12 VDC output)
XR4		Check output (12 VDC output)
XR5		Remote control input (No-voltage contact)
Trf		Transformer

Symbol	Description
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control unit
< mark	FASTON terminal
■ mark	Closed-end splicer

Air feed processing unit: TKUS
TKUSP90, 140M5 140S5



[Description of symbols]

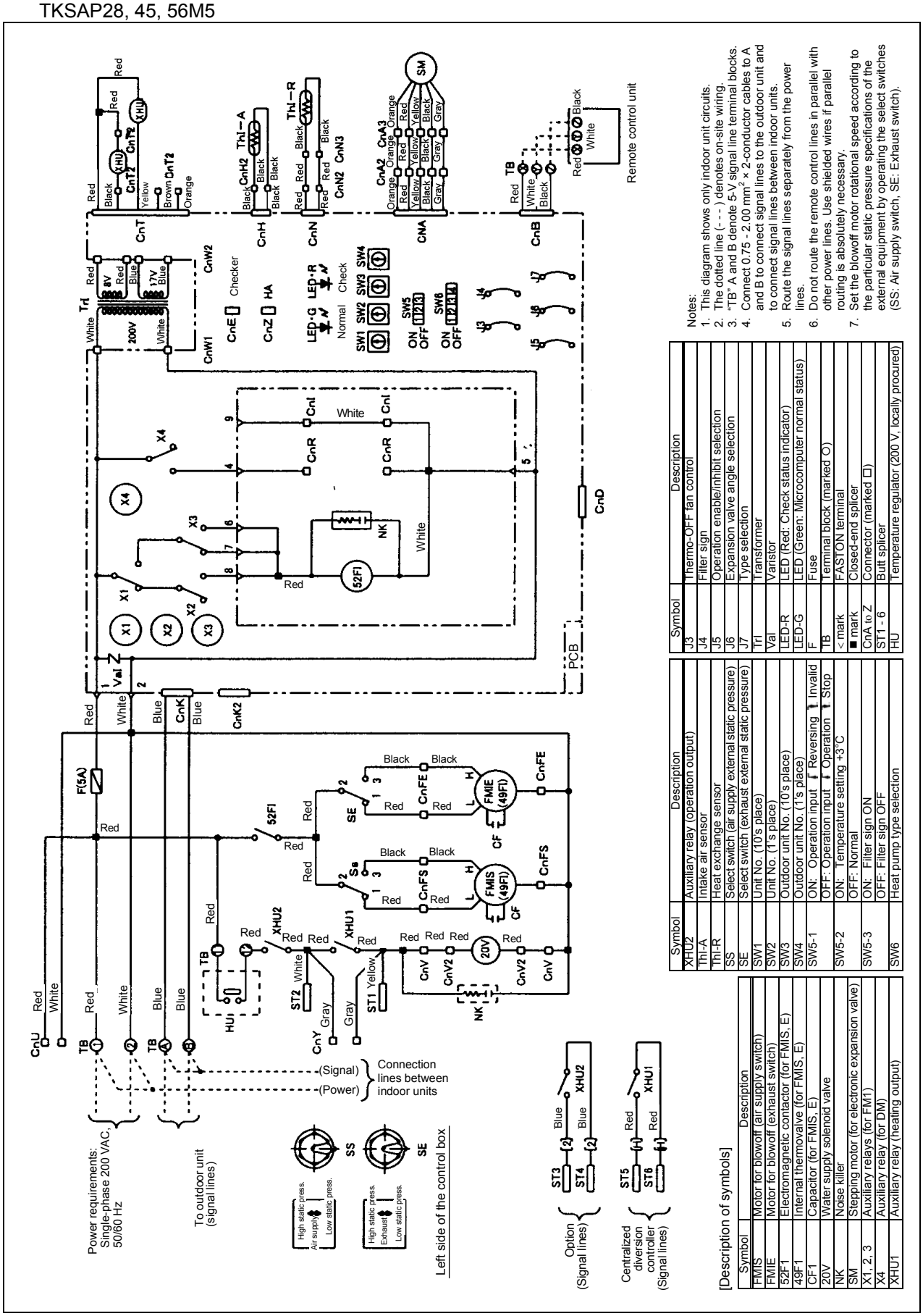
Symbol	Description
FM1	Motor for blowoff
49F1	Internal thermovalve for FM1
CF1	Capacitor for FM1
FS	Float switch
FC	Fan controller
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for optional equipments)
Thi-A	Intake air sensor
Thi-R	Heat exchange sensor
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)

Symbol		Description
SW5-1	ON:	Operation input ↓ Reversing ↑ Invalid
	OFF:	Operation input ↓ Operation ↑ Stop
SW5-2	ON:	Temperature setting +3°C
	OFF:	Normal
SW5-3	ON:	Drain motor ON
	OFF:	Drain motor OFF
SW6	Heat pump type selection	
J3	Thermo-OFF fan control	
J4	Filter sign	
J5	Operation enable/inhibit selection	
J6	Expansion valve angle selection	
J7	Type selection	
CnA to Z	Connector (marked □)	
XR1	Operation output (12 VDC output)	

Symbol	Description
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)
XR5	Remote control input (No-voltage contact)
Tr1	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control unit
< mark	FASTON terminal
■ mark	Closed-end splicer

Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" A and B denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to A and B to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.

Outside-air processing unit: TKSA
TKSAP28, 45, 56M5

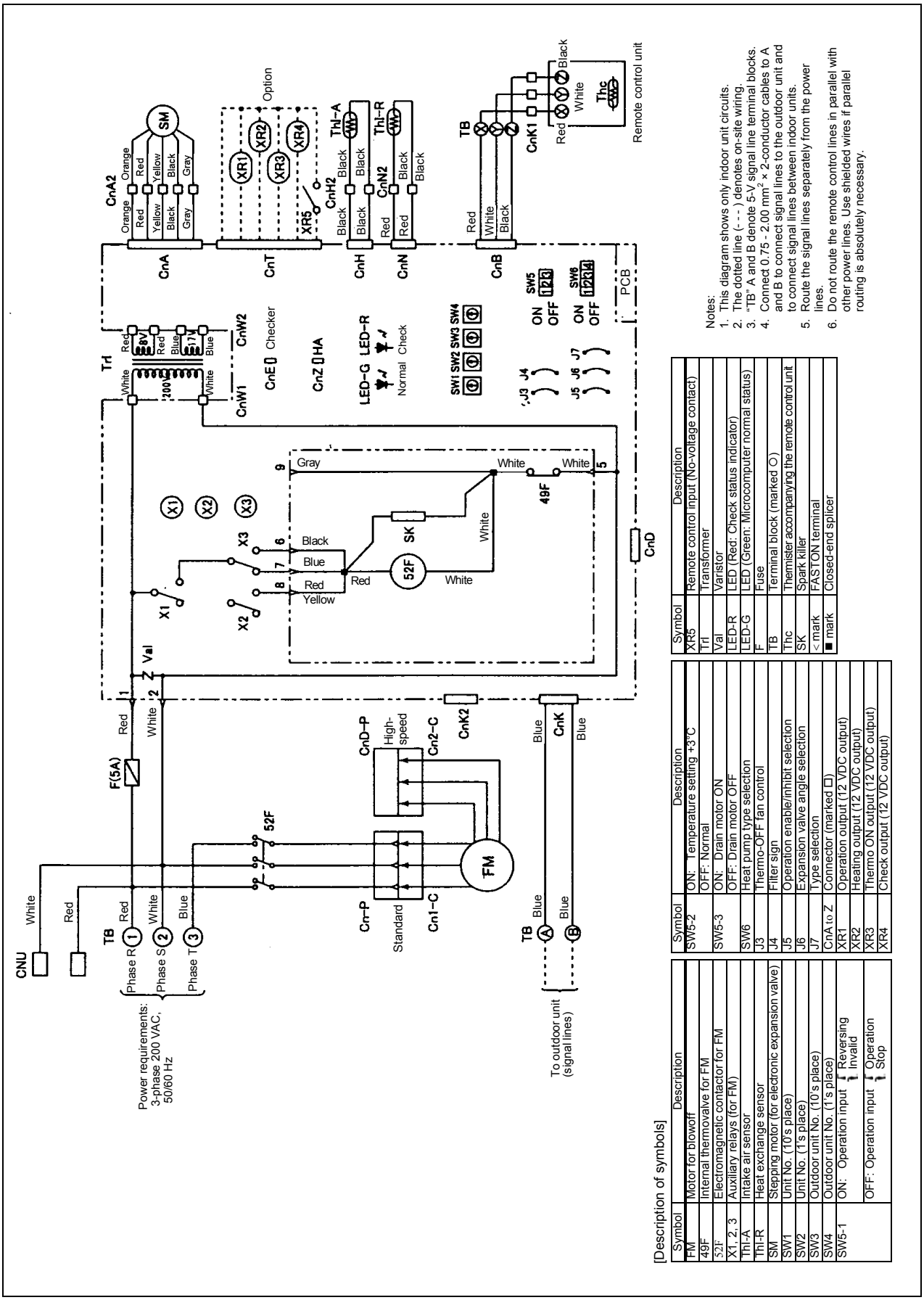


[Description of symbols]

Symbol	Description
FMIS	Motor for blowoff (air supply switch)
FMIE	Motor for blowoff (exhaust switch)
52F1	Electromagnetic contactor (for FMIS, E)
49F1	Internal thermovalve (for FMIS, E)
CF1	Capacitor (for FMIS, E)
20V	Water supply solenoid valve
NK	Noise killer
SM	Stepping motor (for electronic expansion valve)
X1, 2, 3	Auxiliary relays (for FM1)
X4	Auxiliary relay (for DM)
XHU1	Auxiliary relay (heating output)
XHU2	Auxiliary relay (operation output)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SS	Select switch (air supply external static pressure)
SE	Select switch (exhaust external static pressure)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ↓ Reversing ↑ Invalid OFF: Operation input ↓ Operation ↑ Stop
SW5-2	ON: Temperature setting +3°C OFF: Normal
SW5-3	ON: Filter sign ON OFF: Filter sign OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
TB	Terminal block (marked ○)
< mark	FASTON terminal
■ mark	Closed-end splicer
CnA to Z	Connector (marked □)
ST1 - 6	Butt splicer
HU	Temperature regulator (200 V, locally procured)

Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" A and B denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm² × 2-conductor cables to A and B to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.
7. Set the blowoff motor rotational speed according to the particular static pressure specifications of the external equipment by operating the select switches (SS: Air supply switch, SE: Exhaust switch).

Floor-standing duct plenum type: TKFD, TKFP
TKFPP140M5



[Description of symbols]

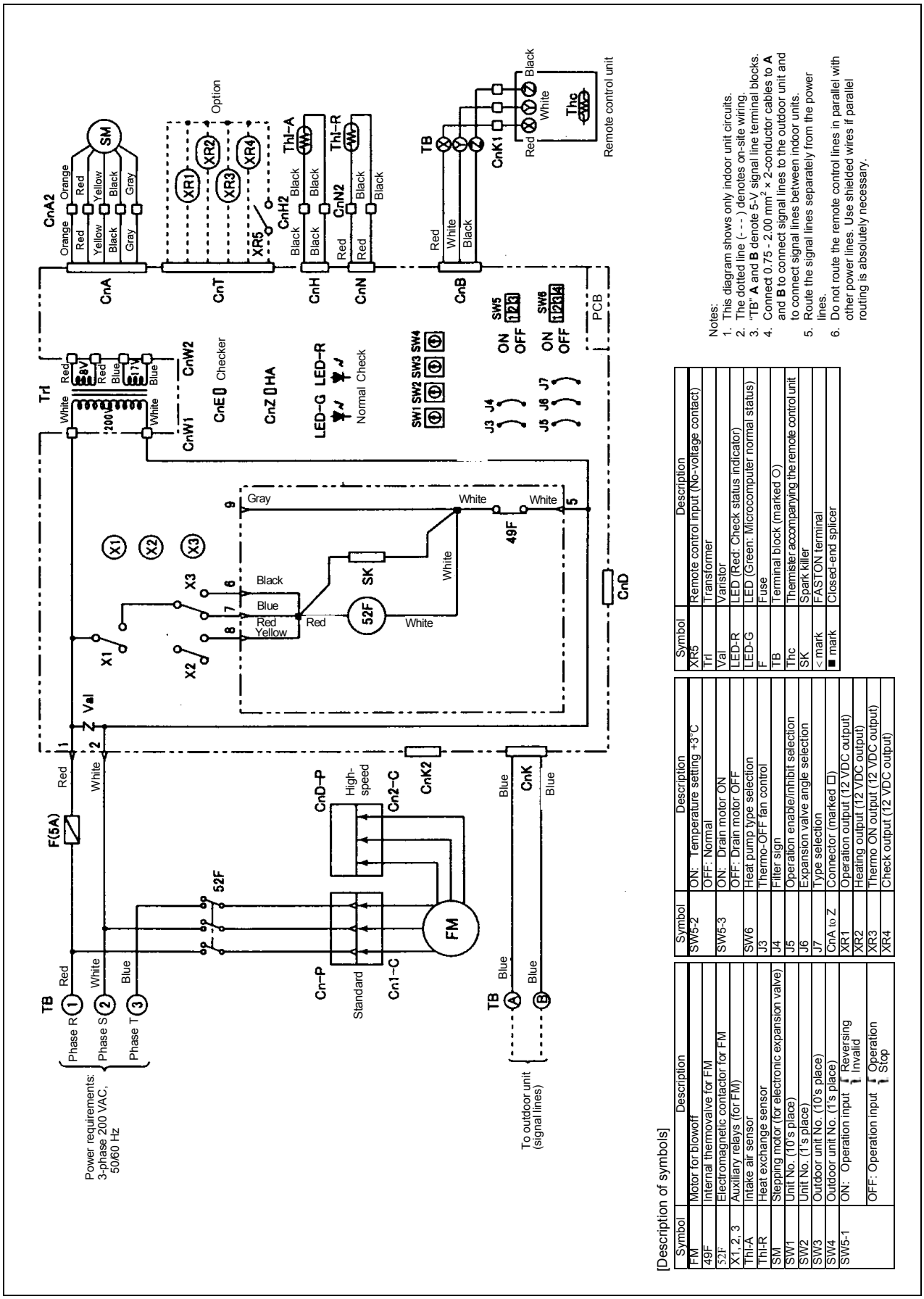
Symbol	Description
FM	Motor for blowoff
49F	Internal thermovalve for FM
52F	Electromagnetic contactor for FM
X1, 2, 3	Auxiliary relays (for FM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ┌ Reversing └ Invalid OFF: Operation input ┌ Operation └ Stop

Symbol	Description
SW5-2	ON: Temperature setting +3°C
	OFF: Normal
SW5-3	ON: Drain motor ON
	OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)

Symbol	Description
XR5	Remote control input (No-voltage contact)
Tri	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control unit
SK	Spark killer
< mark	FASTON terminal
■ mark	Closed-end splicer

Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" A and B denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to A and B to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.

TKFPP224, 280M5 280S5



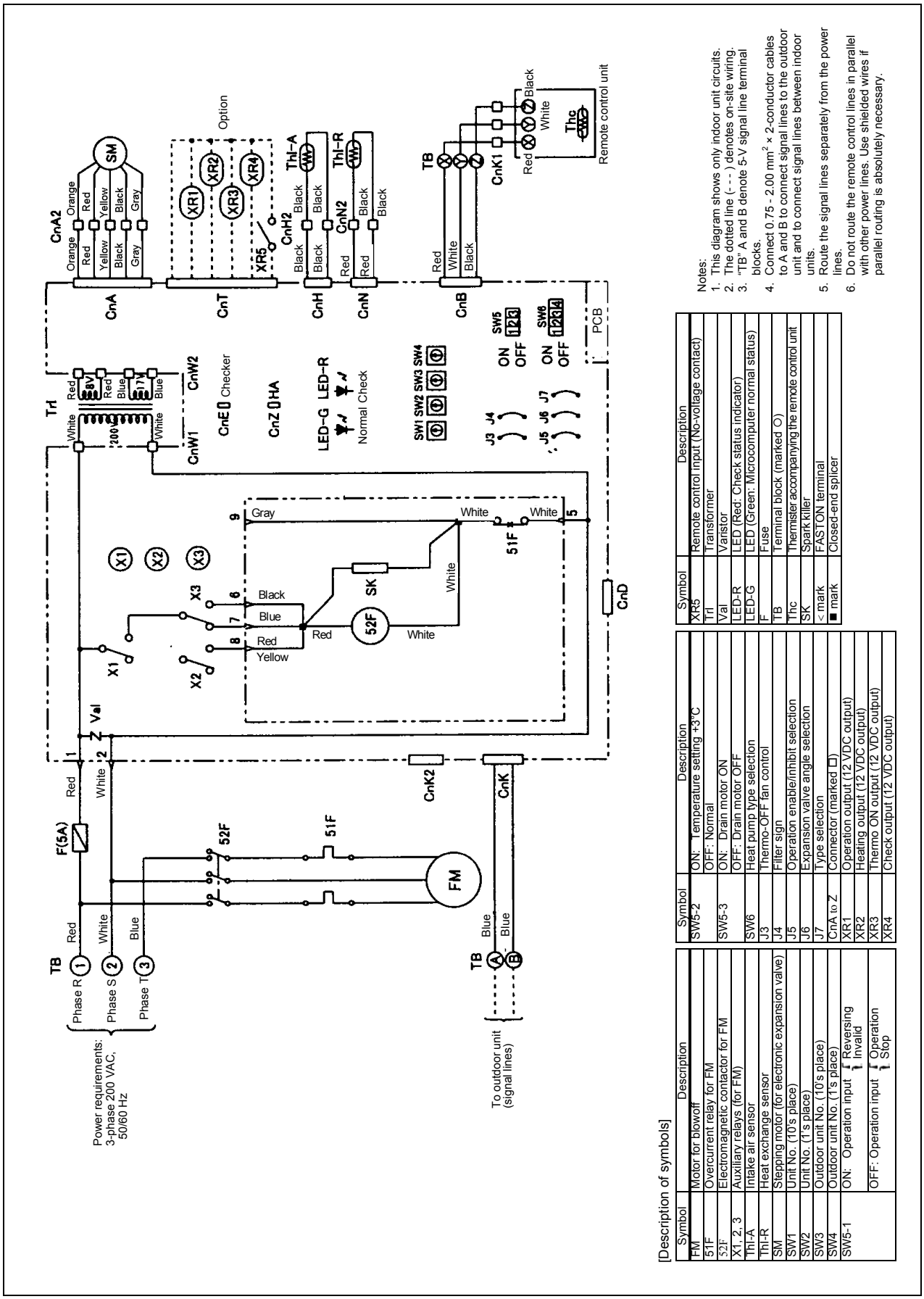
[Description of symbols]

Symbol	Description
FM	Motor for blowoff
49F	Internal thermovalve for FM
52F	Electromagnetic contactor for FM
X1, 2, 3	Auxiliary relays (for FM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input ↓ Reversing ↑ Invalid
	OFF: Operation input ↓ Operation ↑ Stop

Symbol	Description
SW5-2	ON: Temperature setting +3°C
	OFF: Normal
SW5-3	ON: Drain motor ON
	OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)

Symbol	Description
XR5	Remote control input (No-voltage contact)
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control unit
SK	Spark killer
< mark	FASTON terminal
■ mark	Closed-end splicer

TKFDP224, 280M5 280S5



Notes:
1. This diagram shows only indoor unit circuits.
2. The dotted line (- - -) denotes on-site wiring.
3. "TB" A and B denote 5-V signal line terminal blocks.
4. Connect 0.75 - 2.00 mm^2 × 2-conductor cables to A and B to connect signal lines to the outdoor unit and to connect signal lines between indoor units.
5. Route the signal lines separately from the power lines.
6. Do not route the remote control lines in parallel with other power lines. Use shielded wires if parallel routing is absolutely necessary.

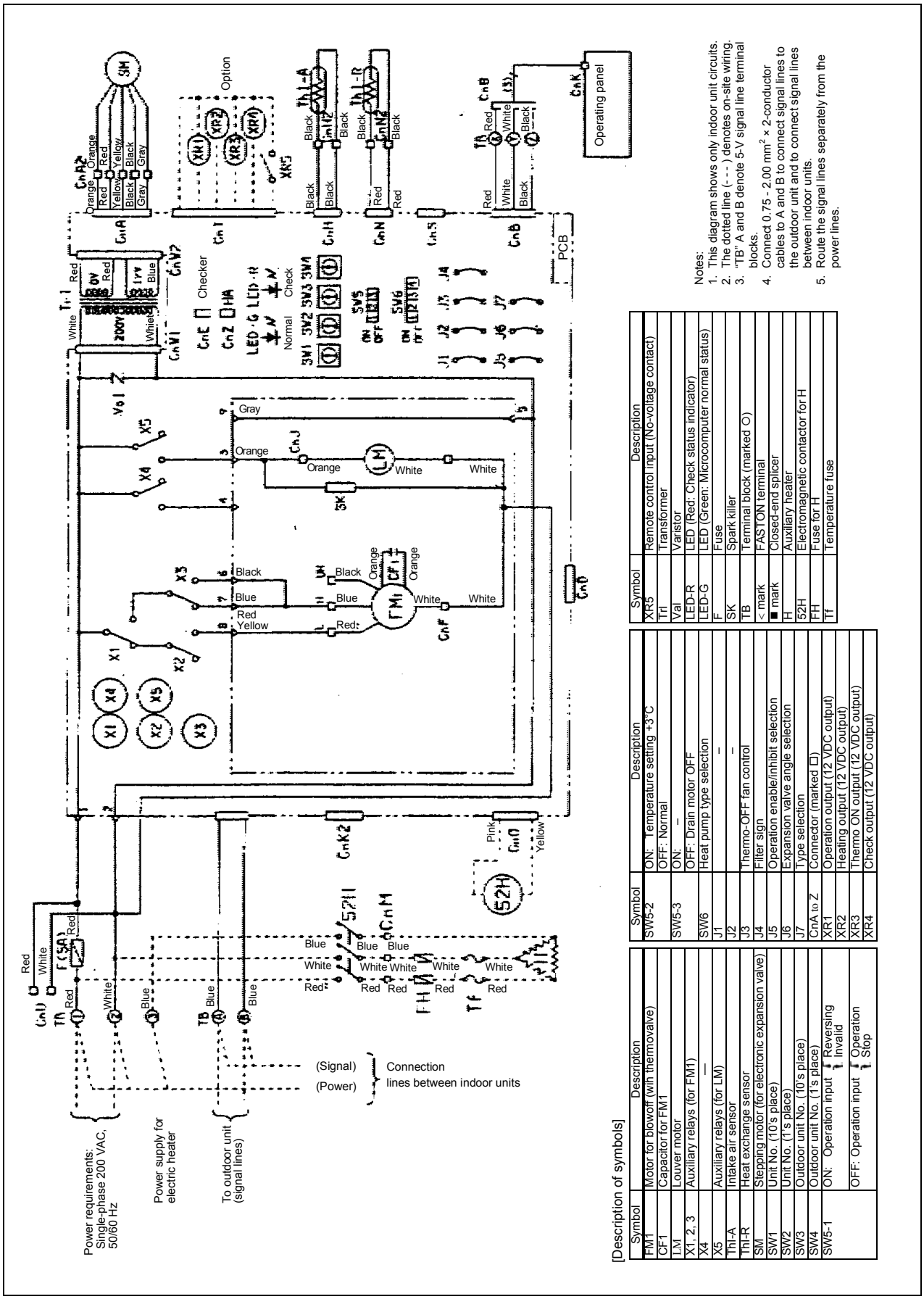
[Description of symbols]

Symbol	Description
FM	Motor for blowoff
51F	Overcurrent relay for FM
52F	Electromagnetic contactor for FM
X1, 2, 3	Auxiliary relays (for FM)
Thl-A	Intake air sensor
Thl-R	Heat exchange sensor
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input { Reversing / Invalid
	OFF: Operation input { Operation / Stop

Symbol	Description
SW5-2	ON: Temperature setting +3°C
	OFF: Normal
SW5-3	ON: Drain motor ON
	OFF: Drain motor OFF
SW6	Heat pump type selection
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)

Symbol	Description
XR5	Remote control input (No-voltage contact)
Tri	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
TB	Terminal block (marked ○)
Thc	Thermister accompanying the remote control unit
SK	Spark killer
< mark	FASTON terminal
■ mark	Closed-end splicer

Floor-standing type: TKF
TKFP80M5, 140M5 140S5



[Description of symbols]

Symbol	Description
FM1	Motor for blowoff (wih thermovalve)
CF1	Capacitor for FM1
LM	Louver motor
X1, 2, 3	Auxiliary relays (for FM1)
X4	—
X5	Auxiliary relays (for LM)
THI-A	Intake air sensor
THI-R	Heat exchange sensor
SM	Stepping motor (for electronic expansion valve)
SW1	Unit No. (10's place)
SW2	Unit No. (1's place)
SW3	Outdoor unit No. (10's place)
SW4	Outdoor unit No. (1's place)
SW5-1	ON: Operation input → Reversing; Invalid
	OFF: Operation input → Operation; Stop

Symbol	Description
SW5-2	ON: Temperature setting +3°C
	OFF: Normal
SW5-3	ON: —
	OFF: Drain motor OFF
SW6	Heat pump type selection
J1	—
J2	—
J3	Thermo-OFF fan control
J4	Filter sign
J5	Operation enable/inhibit selection
J6	Expansion valve angle selection
J7	Type selection
CnA to Z	Connector (marked □)
XR1	Operation output (12 VDC output)
XR2	Heating output (12 VDC output)
XR3	Thermo ON output (12 VDC output)
XR4	Check output (12 VDC output)

Symbol	Description
XR5	Remote control input (No-voltage contact)
Trl	Transformer
Val	Varistor
LED-R	LED (Red: Check status indicator)
LED-G	LED (Green: Microcomputer normal status)
F	Fuse
SK	Spark killer
TB	Terminal block (marked ○)
< mark	FASTON terminal
■ mark	Closed-end splicer
H	Auxiliary heater
52H	Electromagnetic contactor for H
FH	Fuse for H
Tf	Temperature fuse

TROUBLE DIAGNOSIS AND REPAIR

Chapter 3

TROUBLE DIAGNOSIS AND REPAIR

3.1 Circuit base board maintenance functions

Six 7-Segment LED on the outdoor unit control board indicate operation hours and operation situation etc.. In addition, this maintenance function block is able to give mandates for the individual operation of indoor units.

1) Summary of maintenance functions of the control board

□**Mode functions and display**

Mode	Main function	Mode LED
Operation Time	Display of operation time	OFF
Monitoring	Input / output data signal indicator	Green light
Command	Operation command / rotational speed command indicator	Yellow light
Check	Memory data updating and independent activation of various components	Red light

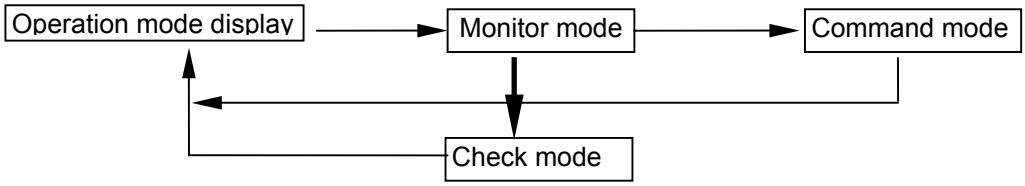
□ In switching the other mode during Command mode, mode LED is lighting color corresponding each mode and blinking yellow five times alternately.□ex. In monitoring mode, mode LED is blinking green and five times yellow alternately.□

□Description for error signal (error LED)

Outdoor unit failure	□Flashing continuously	High
Periodic inspection	□Flashing continuously	
Forcible addition of engine oil	□Flashing 9 times	
Error stop	□Flashing 7 times	
Intake air avoidance	□Flashing 6 times	Priority for display
Exhaust air avoidance	□Flashing 5 times	
High pressure avoidance	□Flashing 4 times	
Water temperature avoidance	□Flashing 3 times	
Low pressure avoidance	□Flashing 2 times	
Normal	□OFF	Low

10 times flashing is one cycle (ex. Flashing 7 of 10 times)

□**How to change to each mode**



→□Press MODE switch for 1 seconds or more

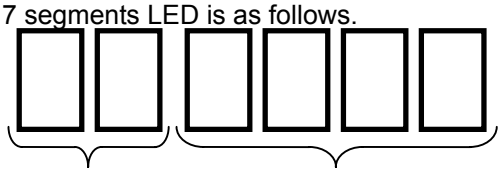
➡□Press Set and Clear switch for 2 seconds or more

It is possible to change to CHECK mode more 3 minutes after power on or compressor off.

Note) It is impossible to change to COMMAND mode and CHECK mode 10 minutes after connected or disconnected to PC checker.

□**7 segments LED**

The description of 7 segments LED is as follows.



If necessary, code no. and indoor unit address is lighting alternately.

Data

□Code Number List

Code No.	Function	Monitor Mode	Command Mode	Check Mode	Remark
01-10	Previous error 1-10	○	□	□	
11	Actual engine RPM□**** min^{-1}□	○	□	□	
12	Requested engine RPM□**** min^{-1}□	○	○	□	
13	Calculated engine RPM□**** min^{-1}□	○	○	□	
15	Throttle valve angle□*** step□	○	□	○	
16	Fuel gas adjustment valve angle□**** step□	○	□	○	
18	Igniter output (□)	○	□	□	
19	Liquid quantity adjustment valve angle□**** step□	○	○	○	
20	Powered three-way valve angle□*** step□	○	○	○	
21	Quantity adjustment valve angle□**** step□	○	○	○	
23	Output of powered equipment for Ventilator 1□*** %□	○	○	○	
24	Output of powered equipment for Ventilator 2□Hi or Lo: *** %□	○	○	○	
27	Output status	○	□	□	
28	Avoidance Status	○	□	□	
29	External Switch status	○	□	□	
31	Individual parts operation [ON]	□	□	○	
32	Individual parts operation [OFF]	□	□	○	
34	Water filling mode (On/Off)	□	□	○	
39	Outdoor unit capacity □*** KW□	○	□	□	
40	Engine operation time□**** hours□hours/10□	○	□	○	
41	Previous periodic check time□**** hours□hours/10□	○	□	○	
42	Right compressor operation time□**** hours□hours/10□	○	□	○	
43	Left compressor operation time□**** hours□hours/10□	○	□	○	
50	Starter on/off count□**** times□times/100□	○	□	○	
51	Engine on/off count□**** times□times/100□	○	□	○	
52	Right compressor on/off count□**** times□times/100□	○	□	○	
53	Left compressor count□**** times□times/100□	○	□	○	
56	Periodic inspection reset (On setting)	□	□	○	
57	Automatic address erase (On setting)	□	□	○	
58	Main micro computer version□**.**□	○	□	□	
59	Engine micro computer version□**.**□	○	□	□	
60	High pressure□*.** MPa□	○	□	□	CN7(8-3-4 pin)
63	High-pressure equivalent temperature□** □□	○	□	□	
66	Engine Cooling water temperature□** □□	○	□	□	CN7(9 pin)
68	Engine exhaust air temperature□*** □□	○	□	□	CN7(13-14 pin)
69	Heat exchanger liquid temperature□-** □□	○	□	□	CN6(1-2 pin)
70	Accumulator inlet temperature □-** □□	○	□	□	CN6(3-4 pin)
71	Right discharge temperature □*** □□	○	□	□	CN6(7-8pin)
72	Left discharge temperature□*** □□	○	□	□	CN6(5-6pin)
73	Gas pipe temperature □-** □□	○	□	□	CN6(9-10 pin)
74	Intake temperature □-** □□	○	□	□	CN6(11-12 pin)
75	Engine room temperature □-** □□	○	□	□	CN6(13-14 pin)
76	Outside temperature □-** □□	○	□	□	CN6(15-16 pin)
79	Target temperature in heating and cooling□*** □□	○	□	□	
90	Indoor unit individual request frequency □*** Hz□	○	□	□	
91	Indoor unit answer frequency□*** Hz□	○	□	□	
92	Indoor unit request frequency□*** Hz□	○	□	□	
94	Indoor unit expansion valve angle (*** steps, controlling oil return)	○	□	○(□1)	
95	Indoor unit quantity□**.* Kw□	○	□	□	
96	Indoor unit target heat exchanger temperature□-** □□	○	□	□	
97	Indoor unit control heat exchanger temperature□-** □□	○	□	□	
98	Indoor unit intake temperature□*** □□	○	□	□	
99	Indoor unit operation status	○	○	□	

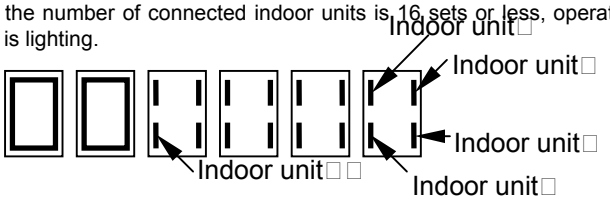
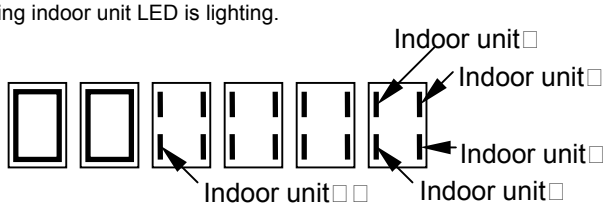
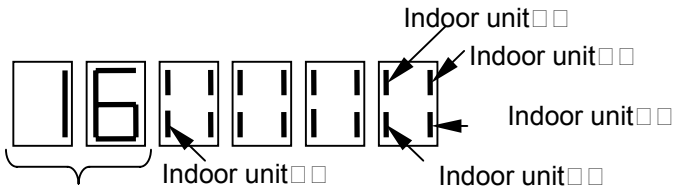
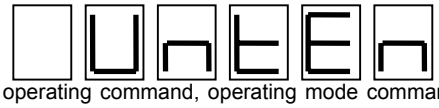
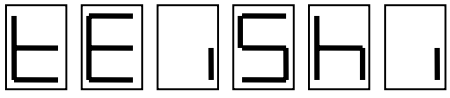
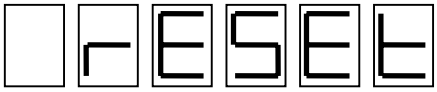
□□□only indoor unit expansion valve fully open status

2) Operating hours display mode

This mode will be set when the outdoor unit in power on.

This mode will also be set when no maintenance function is operated for at least 10 minutes in any other mode

□Function of each switch

Switch status	Switch Function / 7 segments display description
No setting	Display operation hours
Only pressing Code №□□□	Display error status (error code)□In case of multiple errors, the errors are displayed alternately□ Left 2 digits□error main code Right 2 digits□error sub code Ex□Error code Case "80-0" … □□□□□ Case "5-20" … □□□□□ Case "no error" … □
Only pressing Code no. □□□□	Display error stop status (Error Code). (In case of multiple errors, the errors are displayed alternately. The description is the same as the case of "Code no. UP)
Only pressing "Selecting indoor unit"	Display indoor units operation / stop status by 7 segments. □Indoor unit 0 is the minimum indoor unit address. □ In case of the number of connected indoor units is 16 sets or less, operating indoor unit LED is lighting.  □In case the number of connected indoor units is more than 17 sets, display as follows every 2 seconds alternately. The operating indoor unit LED is lighting.   Display of indoor units which number is more than 16.
Only pressing "Mode Selecting "	Change mode (-> monitor mode)
Only pressing "Clear"	No function
Only pressing "Set"	Display of each part output status by 7 segments LED□Please refer to Code no. 27 for the description □
Press both Indoor unit select□Set for one second or more	Operating all of connected indoor units Displaying as follow.  □ Sending operating command, operating mode command and setting temperature to all of indoor units. In more than 23 □, operating in cooling (Setting temp. 18 □) and in less than 23 □, operating in heating (setting temp.30 □)
Press both Indoor unit select □ **Clear** for 1 second or more	Stopping all of connected indoor units. Displaying as follows. 
Press both Code no. □□ □**Clear** for 1 second or more	Reset in error. Displaying as follows. 

3) Monitor Mode

This mode displays each input / output status.

□Function of each switch

Switch status	Switch Function / 7 segments display description
Only pressing Code №□□□	Change code numbers from small number to large number. □00 → 01 → … → 98 → 99 → 00 → 01 → …□
Only pressing Code no. □□□□	Change code number from large number to small number. □00 → 99 → → 98 … → 01 → 00 → 99 → 98 → …□
Only pressing "Selecting indoor unit"	In check each indoor unit data, select the unit you want to display. In pushing the switch, the address of indoor unit is changing. (Use in case more than the code no. 80.) □The minimum of indoor unit address→…→ The maximum address→ - - → The minimum address□
Only pressing "Mode Selecting	Change the mode (-> Command mode)
Only pressing "Clear"	Do not use
Only pressing "Set"	Do not use

□Code number codes in monitor mode

Code no.	Function
01 □ 10	Previous error 1-10
11	Actual engine RPM□**** min^{-1}□
12	Requested engine RPM□**** min^{-1}□
13	Calculated engine RPM□**** min^{-1}□
15	Throttle valve angle□*** step□
16	Fuel gas adjustment valve angle□*** step□
17	Engine igniter angle□-*** °□
18	Igniter output□*□
19	Liquid quantity adjustment valve angle□**** step□
20	Calculated powered three-way valve angle□*** step□
21	Quantity adjustment valve angle□**** step□
23	Output of powered equipment for Ventilator 1□*** %□
24	Output of powered equipment for Ventilator 2□Hi-Lo□*** %□
25	Cooling water pump output□*□
27	Output status
28	Avoidance Status
29	External Switch status
39	Capacity of outdoor unit□*** KW□
40	Engine operation time□**** hours□hours/10□
41	Previous periodic check time□**** hours□hours/10□
42	Right compressor operation time□**** hours□hours/10□
43	Left compressor operation time □**** hours□hours/10□
50	Starter on/off count□**** times□times/100□
51	Engine on/off count□**** times□times/100□
52	Right compressor on/off count□**** times□times/100□
53	Left compressor on/off count□**** times□times/100□
58	Main micro computer version□**.**□
59	Engine micro computer version□**.**□
60	High pressure□*.** MPa□
63	High-pressure equivalent temperature□** □□
66	Engine cooling water temperature□** □□
68	Engine exhaust air temperature□*** □□
69	Heat exchanger liquid temperature□-** □□
70	Accumulator intake temperature□-** □□
71	Right outlet discharge temperature □*** □□
72	Left outlet discharge temperature□*** □□
73	Gas pipe temperature□-** □□
74	Intake temperature□-** □□
75	Engine room temperature□-** □□
76	Outside temperature□-** □□
79	Target temperature in heating and cooling□**□□
90	Indoor unit individual request frequency□*** Hz□
91	Indoor unit answer frequency□*** Hz□
92	Indoor unit request frequency□*** Hz□
94	Indoor unit expansion valve angle□*** step□
95	Indoor unit quantity□**.* Kw□
96	Indoor unit goal heat exchanger temperature□** □□
97	Indoor unit control heat exchanger temperature□** □□
98	Indoor unit intake temperature□** □□
99	Indoor unit operation status

□□□Command Mode

This mode allows the instruction of the indoor units and engine revolutions.

□The function of each switch

Switch status	Switch function/ 7 segments LED display description
Only pressing Code №□□□	Change code numbers from small number to large number. □00 → 01 → … → 98 → 99 → 00 → 01 → …□
Only pressing Code no. □□□□	Change code number from large number to small number. □00 → 99 → → 98 … → 01 → 00 → 99 → 98 → …□
Only pressing "Selecting indoor unit"	In check each indoor unit data, select the unit you want to display. In pushing the switch, the address of indoor unit is changing. (Use in case more than the code no. 80.) □The minimum of indoor unit address→…→ The maximum address→ - - → The minimum address□
Only pressing "Mode Selecting "	Change the mode (-→) Operation hours display)
Only pressing "Clear"	Clear the set data. In setting operation, the current operation status is displayed and, in other indications, the previous status before set is selected.
Only pressing "Set"	Fix the set data. Ex. In case of setting indoor unit operation, in pushing the switch finally, the data is sent to the indoor unit.

□Code numbers List of Command mode

Code no.	Function	Width	Set Range
12	Requested engine RPM□**** min^{-1}□	±□□	Min. to max.
13	Calculated engine RPM□**** min^{-1}□	±□□	Min. to max.
19	Liquid quantity adjustment valve angle□**** step□	——	60 to 2000
20	Calculated powered three-way valve angle□*** step□	——	12 to 820
21	Quantity adjustment valve angle□**** step□	——	60 to 2000
23	Output of powered equipment for Ventilator 1□*** %□	±□	0 to 100
24	Output of powered equipment for Ventilator 2□**** %□	±□	Hi/Lo: 0 to 100
99	Indoor unit operation status□***□	——	——

□□□Check mode

Renew the memorized data and indicate each unit operation.

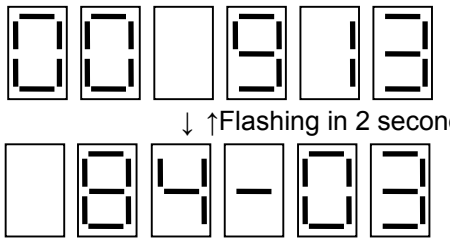
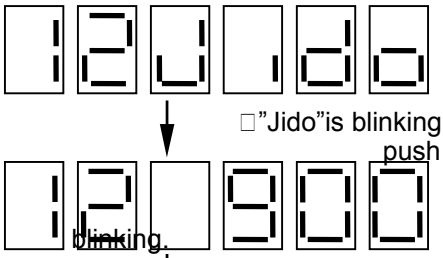
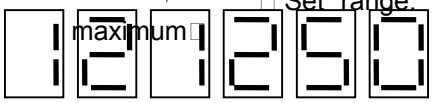
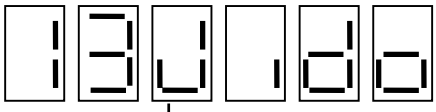
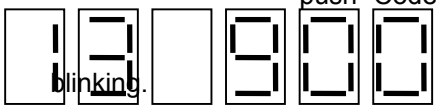
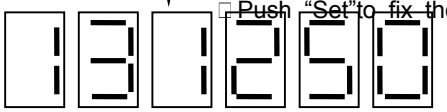
□Function of each switch

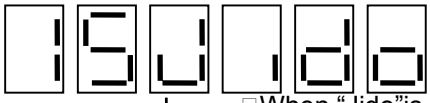
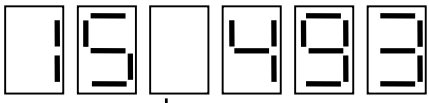
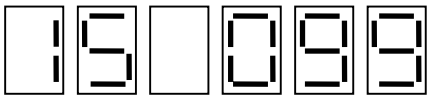
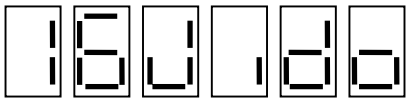
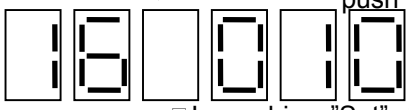
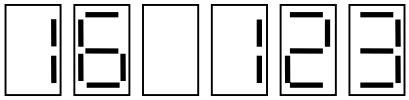
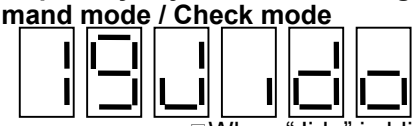
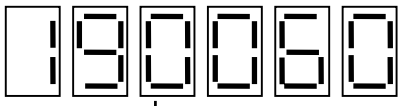
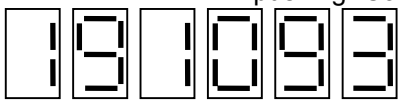
Switch status	Switch function/ 7 segments LED display description
Only pressing Code №□□□	Change code numbers from small number to large number. □00 → 01 → … → 98 → 99 → 00 → 01 → …□
Only pressing Code no. □□□□	Change code number from large number to small number. □00 → 99 → → 98 … → 01 → 00 → 99 → 98 → …□
Only pressing "Selecting indoor unit"	In checking each indoor unit data, select the unit you want to display. In pushing the switch, the address of indoor unit is changing. (Use in case more than the code no. 80.) □The minimum of indoor unit address→…→ The maximum address→ - - → The minimum address□
Only pressing "Mode Selecting "	Change the mode (-→) Operation hours display)
Only pressing "Clear"	Clear the set data. In setting operation, the current operation status is displayed and, in other indications, the previous status before set is selected.
Only pressing "Set"	Fix the set data. Ex. In case of setting indoor unit operation, in pushing the switch finally, the data is sent to the indoor unit.

□Code no. list in Check mode

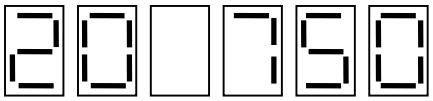
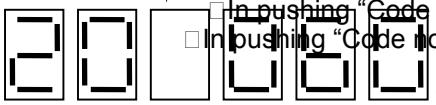
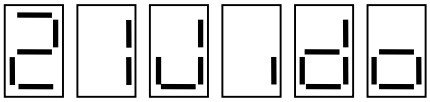
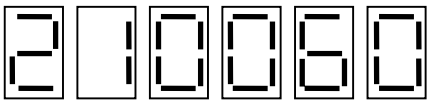
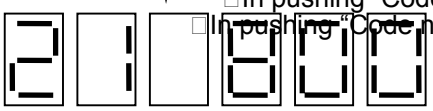
Code no.	Function	Set range
15	Throttle valve angle□*** step□	90 to 493
16	Fuel gas adjustment valve angle□*** step□	10 to 140
19	Liquid quantity adjustment valve angle□**** step□	60 to 2000
20	Calculated powered three-way valve angle□*** step□	12 to 820
21	Quantity adjustment valve angle□**** step□	60 to 2000
23	Output of powered equipment for Ventilator 1□*** %□	0 to 100
24	Output of powered equipment for Ventilator 2□**** %□	Hi/Lo:0 to 100
31	Individual part operation (ON)	On
32	Individual part operation (Off)	Off
34	Water filling mode (On/Off)	On / Off
35	Engine oil supply mode□On setting□	On
40	Engine operation time □**** hours□hours/10□	0 to 6553
41	Previous periodic check time□**** hours□hours/10□	0 to 6553
42	Right compressor operation time□**** hours□hours/10□	0 to 6553
43	Left compressor operation time□**** hours□hours/10□	0 to 6553
50	Starter on/off count□**** times□times/100□	0 to 5898
51	Engine on/off count□**** times□times/100□	0 to 5898
52	Right compressor on/off count□**** times□times/100□	0 to 5898
53	Left compressor on/off count□**** times□times/100□	0 to 5898
56	Periodic inspection reset □On setting□	On
57	Automatic address erase□On setting□	On
94	Indoor unit expansion valve angle□***step□	Only full open

□□□Instruction□Description

Code №□	Instruction□Description
01 02 03 04 05 06 07 08 09 10	**●Previous error 1-10** **○Monitor Mode** ex. Engine micro computer communication error (84-3) when the operation time is 9130 hours  ↓ ↑Flashing in 2 seconds
12	**●Requested Engine RPM** **○Command Mode**  In pushing□Set□□"Jido"is blinking. □"Jido"is blinking, push□Code no. UP□□□ Code №□Down□ The current engine RPM is blinking. Ex) 900 min^{-1} □In pushing□Code no. □□□ □□□ min^{-1} □In pushing□Code no.□□□□□□□□□min^{-1} □In pushing□Code no. □□□□□Code no. □□□□□"Jido"is blinking □Push the "Set" to fix the RPM. □Set range: From the minimum requested RPM to the maximum□  The display changes blinking to flashing continuously. ex□1250min^{-1}
13	**●Calculated Engine RPM** **○Command Mode**  In pushing "Set", "Jido"is blinking. □When "Jido" is blinking, push" Code no. UP"+ "Code no. Down"  The current calculated RPM is blinking. ex□□□□min^{-1} □In pushing "Code no. UP", □□□min^{-1}□ □In pushing "Code no. Down", □□□min^{-1}□ □In pushing "Code no. UP"+ "Code no. Down" "Jido" is blinking.  □Push "Set"to fix the RPM.□Set range :From the minimum to the maximum□ The display changes from blinking to flashing continuously. Ex□1250 min^{-1}

15	**●Throttle valve angle** **○Check Mode**  In pushing “set, “Jido”is blinking. □When “Jido”is blinking, push “Code no. UP”+ ”Code no. Down”  The hundred’s place of the current throttle valve angle is blinking. ex□□□□step □In pushing ”Set”, the blinking place changes from the hundred’s place, the ten’s place to one place of the current angle. □In pushing “Code no. UP”,□ → … → □ → □ → … → □ □In pushing “Code no. DOWN”, □ → … → □ → □ → … → □  □When the one place is blinking, push “Set”. The display is blinking. Then, push “Set” to fix the angle. (set range: 90 step to 493 step) The display change from blinking to flashing. ex□99steps
16	**●Fuel gas adjustment valve angle** **○Check Mode**  When push “Set”, “Jido”is blinking**.** □When “Jido”is blinking, push “Code no. UP”+ ”Code no. Down”  The hundred’s place of the current fuel gas adjustment valve angle is blinking. Ex)□□step □In pushing ”Set”, the blinking place changes from the hundred’s place, the ten’s place to one’s place of the current angle. □In pushing “Code no. UP”,□ → … → □ → □ → … → □ □In pushing “Code no. DOWN”, □ → … → □ → □ → … → □  □When the one’s place is blinking, push “Set”. The display is blinking. Then, push “Set” to fix the angle. (set range: 10 steps to 140 steps) The display is from blinking to flashing continuously Ex.□123 steps
19	**●Liquid quantity adjustment valve angle** **○Command mode / Check mode**  In pushing “Set”, “Jido” is blinking. □When “Jido” is blinking, push “Code no. UP”+ ”Code no. Down” The thousand’s place of the current refrigerant liquid quantity angle is blinking  Ex.□60 steps □In pushing ”Set”, the blinking place changes from the thousand’s place, the hundred’s place, the ten’s place to one’s place of the current angle. □In pushing “Code no. UP”,□ → … → □ → □ → … → □ □In pushing “Code no. DOWN”, □ → … → □ → □ → … → □  □When the one’s place is blinking, push “Set”. The display is blinking. Then, push “Set” to fix the angle. (set range: 60 steps to 2000 steps) The display is from blinking to flashing

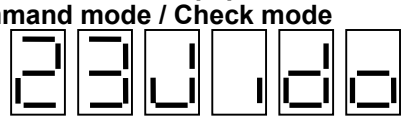
	continuously. Ex.1093 steps

20	**●Powered three-way valve angle** **○Command mode□Check mode**  In pressing “Set”, “Jido” is blinking. □When “Jido” is blinking, push “Code no. UP”+ ”Code no. Down”  The hundred’s place of the powered three-way valve angle is blinking. ex□750 steps □In pushing ”Set”, the blinking place changes from the thousand’s place, the hundred’s place, the ten’s place to the one’s place of the current angle. □In pushing “Code no. UP”,□ → … → □ → □ → … → □ □In pushing “Code no. DOWN”, □ → … → □ → □ → … → □  □When the one’s place is blinking, push “Set”. The display is blinking. Then, push “Set” to fix the angle.(set range: 12 steps to 820 steps) The display changes from blinking to flashing continuously. Ex.□60 steps
21	**●The capacity adjustment valve angle** **○Command mode/Check mode**  In pressing “Set”, “Jido” is blinking. □When “Jido” is blinking, push “Code no. UP”+ ”Code no. Down”  The thousand’s place of the current capacity adjustment valve angle is blinking. Ex□60 step □In pushing ”Set”, the blinking place changes from the thousand’s place, the hundred’s place, the ten’s place to the one’s place of the current angle. □In pushing “Code no. UP”,□ → … → □ → □ → … → □ □In pushing “Code no. DOWN”, □ → … → □ → □ → … → □  □When the one’s place is blinking, push “Set”. The display is blinking. Then, push “Set” to fix the angle. (set range: 60 steps to 2000 steps) The display changes from blinking to flashing continuously. Ex□□□□step

23

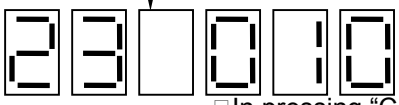
●Output of electric equipment for Ventilator 1

○Command mode / Check mode



In pushing “Set”, “Jido”is blinking.

□When “Jido”is blinking, push “Code no. UP”+ ”Code no. Down”



The current duty ratio of the electrical equipment for ventilator 1 is blinking.

ex□The current duty ratio of the electrical equipment for ventilator 1 is 10%.

□In pressing “Code no. UP”□□ □

□In pressing “Code no. DOWN”□□□

□In pressing “Code no. UP”+”Code no. DOWN”, “Jido” is blinking.

□Press “Set” to fix the setting. (range:□ □ □ □□□ □)

The display changes from blinking to flashing continuously.

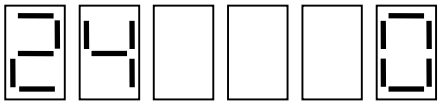
ex□The current duty ratio of the electrical equipment for ventilator 1 is 100%.

24

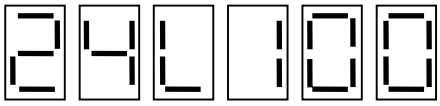
●Output of electric equipment for Ventilator 2

○Monitor mode

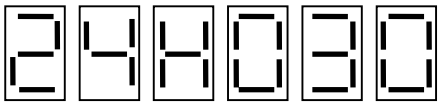
Ex) The electrical equipment of ventilator 2 is stopped.



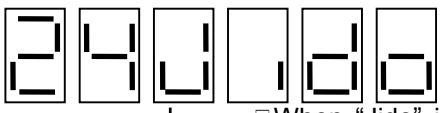
Ex□The duty ratio of the electrical equipment for ventilator 2-L is 100%.



Ex□The duty ratio of the electrical equipment for ventilator 2-H is 30%.

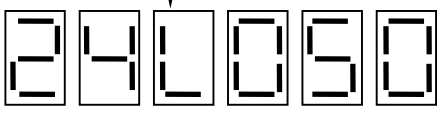


○Command mode / check mode



In pressing “Set”, “Jido” is blinking.

□When “Jido” is blinking, push “Code no. UP”+ ”Code no. Down”



The L or H, the current status of the electrical equipment for the ventilator 2 is blinking.

Ex) The duty ratio of the electrical equipment for ventilator-2-L is 50%.

When the L or H is blinking,

If pressing “Code no. UP”, the electrical equipment for ventilator 2-H is set.

If pressing “Code no. DOWN”, the electrical equipment for ventilator 2-L is set.

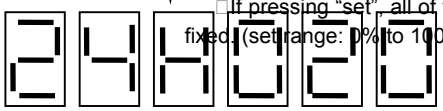
□If pressing “Set” , the number is blinking.

□When the number is blinking,

If pressing “Code no. UP”, the duty ratio become plus 5%.

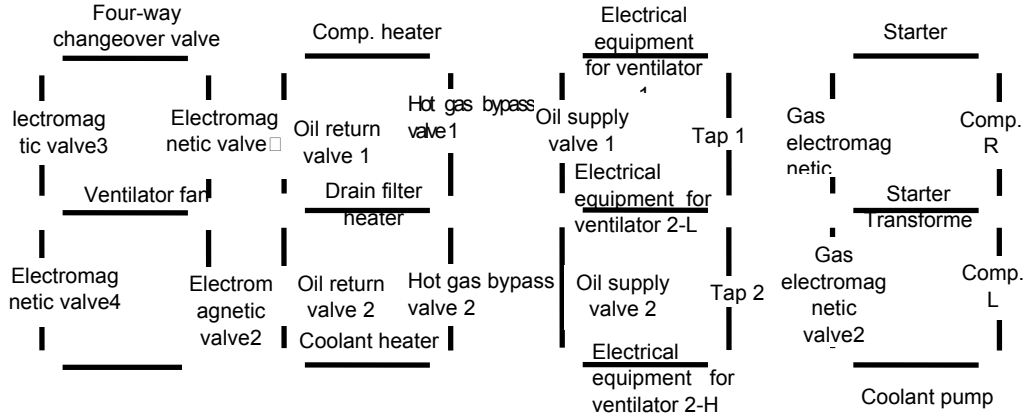
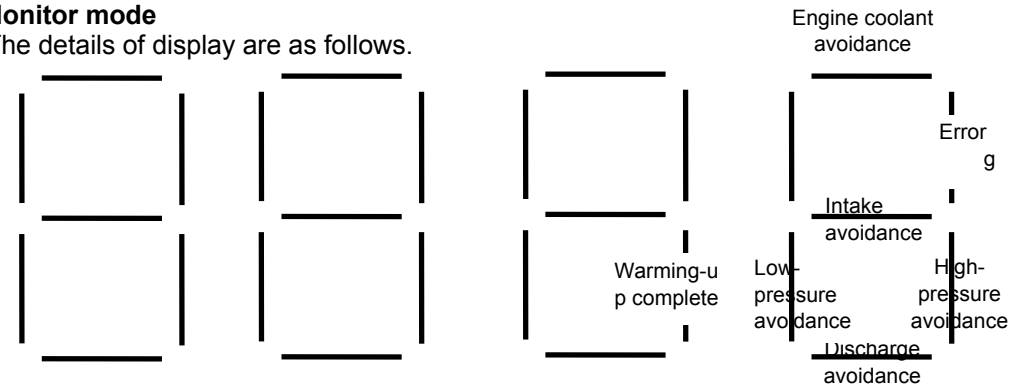
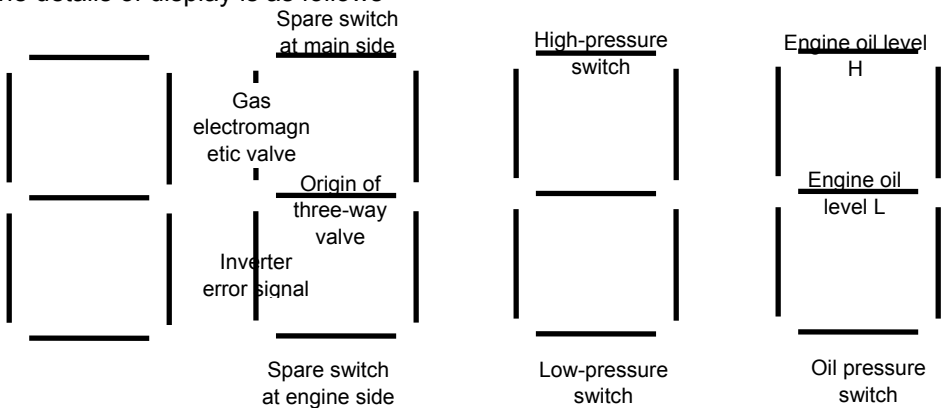
If pressing “Code no. DOWN”, the duty ratio become minus 5%.

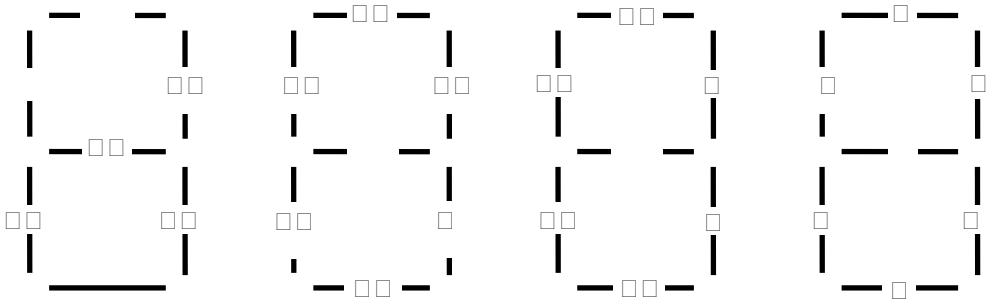
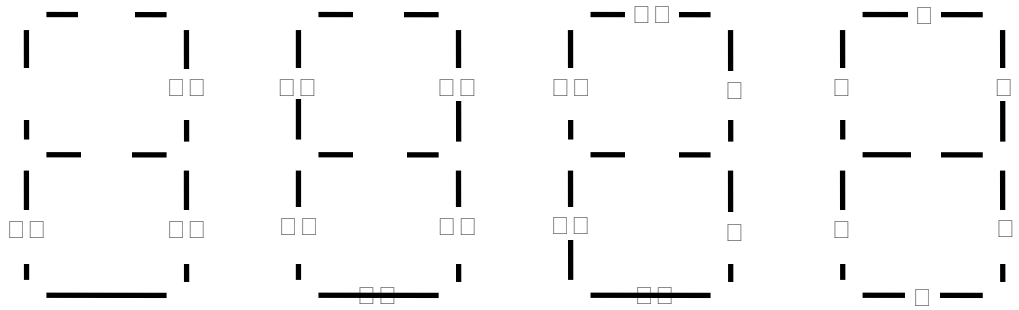
□If pressing “set”, all of the data is blinking. After that, pressing “set”, the data is fixed. (set range: 0% to 100%)



The display changes from blinking to flashing continuously.

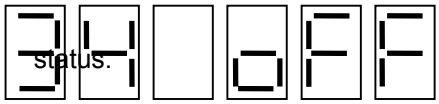
ex) The duty ratio of the electrical equipment for ventilator 2-H is 20%

27	**●Output Description** **○Monitor Mode** The description of indicator is following. 
28	**●Avoidance Description** **○Monitor mode** The details of display are as follows. 
29	**●External switch status** **○Monitor mode** The details of display is as follows 

31	**●Operating each part "ON"** **○Check mode** The place for each part is as follows.  1. Compressor R 2. Compressor L 3. Gas electromagnetic valve 1 4.Gas electromagnetic valve 2 5. Starter 6. Starter transformer 7. Coolant pump 12□Electrical equipment for ventilator 1 13□Electrical equipment for ventilator 2-L 14□Electrical equipment for ventilator 2-H 15□Hot gas bypass valve 17. Oil return valve 1 18. Oil return valve 2 19. Compressor heater 20. Drain filter heater 21□Coolant heater 26□Four-way changeover valve 27□Ventilator fan When pressing **"Set"**, one segment is blinking. Then, if pressing **"Code no, UP"**, each segment is blinking from small to large number one by one, like 1→2→ … →27→28→1. If pressing **"Code no. DOWN"**, each segment is blinking from large to small number one by one, like 1→28→27→ … →2→1 When the segment of the part which you want to turn on is blinking if **"Set"** is pressed, the part is operated. The operation time of Starter is 5 seconds, those of other parts are 3 minutes.
32	**●Individual operation of parts "OFF" 1** **○Check mode** Position of each part is following.  1. Compressor R, 2. Compressor L, 3. Fuel gas electromagnetic valve 1, 4. Fuel gas electromagnetic valve 2, 5. Starter, 6. Starter transformer 7. Coolant pump, 12□Electrical equipment for ventilator 1, 13□Electrical equipment for ventilator 2-L, 14□Electrical equipment for ventilator 2-H, 15□Hot gas bypass valve 1, 16□Hot gas bypass valve 2, 17□Oil return valve 1, 18□Oil return valve 2 19□Compressor heater, 20□Drain filter heater, 21□Coolant heater, 26□Four-way changeover valve, 27. Ventilator fan When pressing **"Set"**, one segment is blinking. Then, if pressing **"Code no, UP"**, each segment is blinking from small to large number one by one, like 1→2→ … →27→28→1. If pressing **"Code no. DOWN"**, each segment is blinking from large to small number one by one, like 1→28→27→ … →2→1 When the segment of the part which you want to turn on is blinking, if **"Set"** is pressed, the part is operated. When all segments are blinking, if "set" is pressed, all parts are stopped.

34

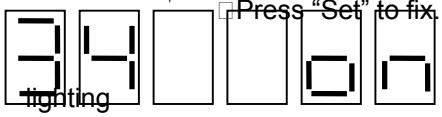
●Supply water mode
○Check mode



Display of the current supply water status.

Ex.) Water supply OFF

□The display is flashing in pressing "Set"
□When pressing "Code no. UP" or "Code no. DOWN", ON and OFF is displayed alternately
□Press "Set" to fix. □Setting range□ON or Off□



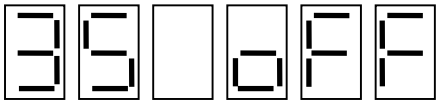
The display change from flashing to lighting

ex□Water supply on

Supplying water for 5 minutes at maximum..

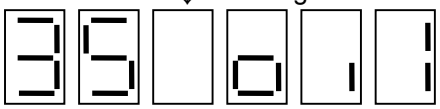
35

●Engine oil supply mode
○Check mode



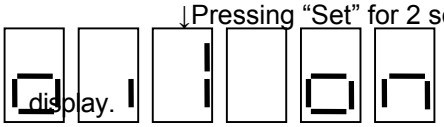
OFF is displayed on the data display.

↓ Pressing "Set".



"Oil" is blinking on the data display

↓Pressing "Set" for 2 seconds or more, the data is fixed.

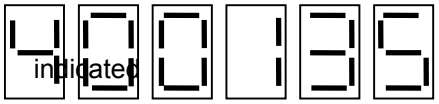


"Oil on" is displayed on the data display.

Keep this mode by power-off. It is invalid to turn on the switch.

40
41
42
43

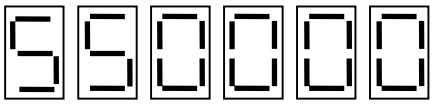
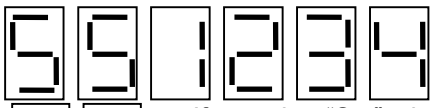
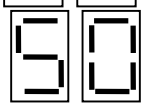
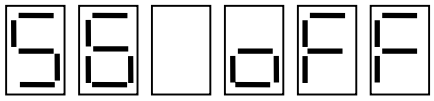
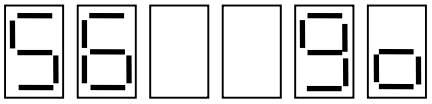
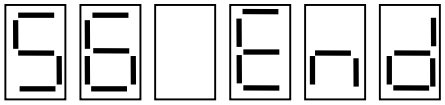
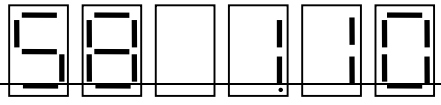
●Engine operation time(40)
●Previous periodic inspection time(41)
●Compressor R operation time(42)
●Compressor L operation time(43)
○Check mode

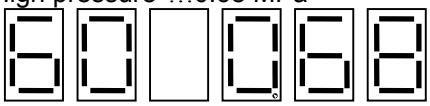
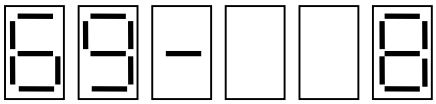


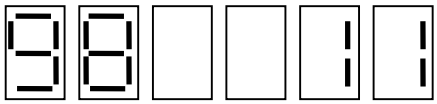
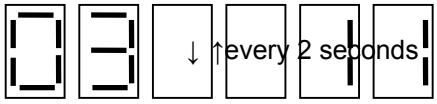
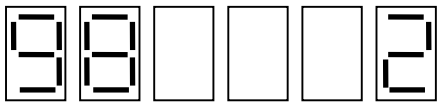
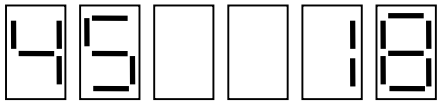
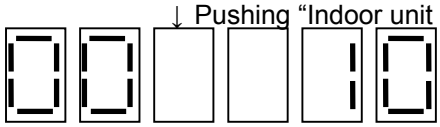
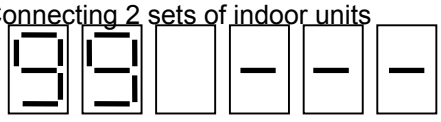
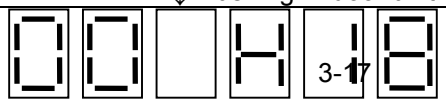
The present operation time is indicated.

Ex) Engine operation time is 1350 hours/10.

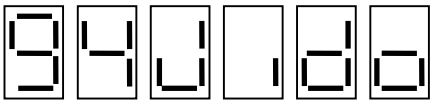
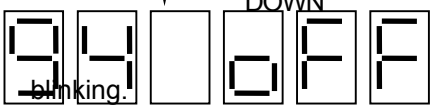
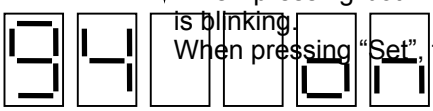
When pressing **"Set",** each digit is blinking from thousand's place →hundred's place → ten's place → one place.
If pressing "Code no. UP" , the number changes from small to larger number, like 0→ … →9→0→ … →9.
If pressing "Code no. down", the number changes from small to larger number, like 9→…→0→9→…→0.
When the one's place is blinking and "Set" is pressed, all indicators for data are blinking. Then, if pressing "Set", the data is fixed.
(Setting range:0 * 10 □ 6553 * 10 hours)
The indicator changes from blinking to flashing continuously. Ex) 65530 hours/ 10

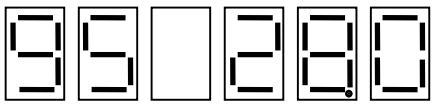
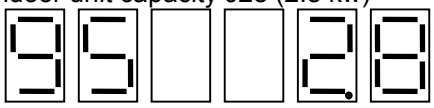
50 51 52 53	●**Engine on/off count (50)** ●**Starter on/off count (51)** ●**Compressor R on/off count (52)** ●**Compressor L on/off count (53)** ○**Check mode**  The present on/off number is flashing Ex) Engine on/off count is 0. When pressing “Set”, each place is blinking from large to small place, 1000 → 100 → 10 → 1. If pressing “Code no. UP”, the number changes from small to large, like 0→…→9→0→…→9.  If pressing “Code no. DOWN”, the number changes from large to small, like 9→…→0 →9→…→0  If pressing “Set” when one’s place is blinking, all data is blinking. Then, if pressing “Set”, the data is fixed. (Setting range: 0 to 9999 /100 times) The data indicator changes from blinking to flashing continuously. Ex) 123400 / 100 times
56 57	●**Periodic inspection reset**□□□□ ●**Automatic address erase**□□□□ ○**Check Mode**  Displayed “OFF” ↓ Press “Set”  Displayed “Go” ↓ Press “Set” in more 2 seconds or more to fix the indication  Displaying “End” **Note: Power off after automatic address erase** If not power off, error (E1) will happen.
58 59	●**Main Microcomputer Version**□□□□ ●**Engine Microcomputer Version**□□□□ ○**Monitor Mode** Ex□Engine Micro Computer version… Ver.1. 10□□□□□□□ 

60	**●Pressure displayed** **○Monitor Mode** Ex□High pressure …0.68 MPa 
63 □ **76**	**●Temperature displayed** **○Monitor mode** Ex□□□□□1-2 pin□temperature … □□□ 

80□99	**●Indoor unit and periphery**□Ex□When connecting indoor unit no.□□□□□□□□□□ **○In not selecting indoor unit**  Ex□Indoor unit 3 Displaying indoor unit intake temperature (11□)  ↓ ↑every 2 seconds Displaying Code no. and indoor unit address alternately. **○In selecting indoor unit□monitor mode is displayed**  Ex) Displaying the indoor unit intake temperature of Indoor unit 11(2□) ↓ Pushing “Indoor unit select”  Ex) Display indoor unit intake temperature of Indoor unit address 45 (18□) ↓ Pushing “Indoor unit select”  When the number is more than the number of connected indoor units, the indoor unit address returns to the minimum number address. **○In selecting indoor unit, command mode and check mode** Ex□Connecting 2 sets of indoor units  Ex.)Display the operation status (Stop) of indoor unit address 11. ↓ Pushing “Indoor unit select”  Ex□Display the operation status of indoor unit 45 (Air ventilating) ↓ Pushing “indoor unit select”  Select all sets of the connected indoor units. Display the operation status of the minimum number of indoor unit. ↓ Pushing “indoor unit select” 

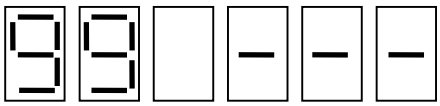
	When the number is more than the number of connected indoor units, the indoor unit address returns to the minimum number address.

94	**●Indoor unit expansion valve angle** **○Check mode**  In pressing “Set”, “Jido” is flashing. When “Jido” is blinking, pressing both “Code no. UP” and “Code no. DOWN”  The present oil return condition is blinking. Ex) Oil return is OFF. When pressing “Code no. UP”, the oil return is ON. When pressing “Code no. DOWN”, the oil return is OFF. When pressing both “Code no. UP” and “Code no. DOWN”, “Jido” is blinking.  When pressing “Set”, the display is fixed (Setting range: ON / OFF) The display changes from blinking to flashing continuously. Ex) Oil return is ON.

95	●**Display of indoor unit capacity** ○**Monitor mode** ex) Indoor unit capacity J280 (28.0 kw)  ex) Indoor unit capacity J28 (2.8 kw) 

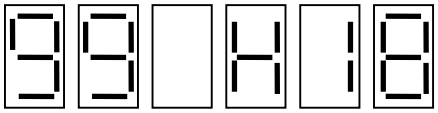
99

●Indoor unit operation condition
○Command mode



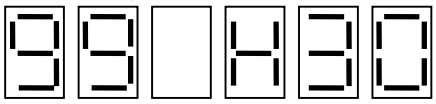
Operation condition of selected indoor unit address is blinking.
Ex) When the selected indoor unit is stopped.

When pressing “Set”, the hundred’s place is blinking.
When the hundred’s place is blinking if “Code no.UP” is pressed, li□
→F→J→C→H
If “Code no. DOWN” is pressed, H→C→J→F→ □
When “Set” is pressed, the value is blinking.



Ex) Heating setting

When the value is blinking, if “Code no. UP” is pressed, the value changes from small to large number like18→ 19 → … → 30 → cr.
If “Code no. DOWN” is pressed, the value changes from large to small number like cr → 30 → … → 19 → 18.
If press “Set” , all data is blinking. Then, pressing “set”, the value is fixed.



The display of data changes from blinking to flashing continuously.
Ex) heating mode, set temp. 30□

Display of Indoor unit operation condition (data) is following.

Ex) Cooling, set temp. 19 □	setting	--- C19
Heating, set temp. 30□	setting	--- H30
Dehumidify , set temp 18□	setting	--- J18
Ventilation	Setting	--- F - -
Stop	Setting	--- - - -
Cooling test operation	Setting	--- Ccr
Heating test operation	Setting	--- Hcr

□ Range of set temperature… 18□ to 30□

In cooling test operation, the set temperature is the present target temperature which is set presently.

3.2 Trouble Items and Diagnosis

3.2.1 Error Codes, Contents, and Major Likely Causes

Alarm Code			Contents	Diagnosis and Repair	
Display of Remote Control Unit	Maintenance Board				
	Code	Sub-Code		Major Likely Causes	Diagnosis/Remedy
E1	1	0	Communication error between the indoor unit and the remote control unit	1) Power-off of some specific indoor units during multiple indoor unit control from one remote control unit 2) Incomplete contact or wire disconnections of the remote control unit signal line (white) 3) Noise in the remote control cable 4) Indoor unit circuit board fault (CPU uncontrollable)	1) Measure the supply voltage at the power terminal block of the indoor unit. 2) Confirm power W, the power fuses, and the power transformer. 3) Confirm the electrical continuity, insulation, and polarity of the remote control signal line. 4) Confirm the color and voltage of the remote control signal line (black or red, 10 VDC). 5) Cut off the noise induction route and/or shield the remote control cable. 6) If the abnormality cannot be corrected even by resetting the power system, confirm the circuit board of the indoor unit.
E2	2	0	Indoor unit address number overlapping	1) Indoor unit address number overlapping	1) Confirm the address number settings of the indoor unit (indoor unit address Nos. U0 to U47 must be free from overlapping).
E3	—		Pairing error	1) The outdoor unit is powered off or the CPU on the circuit board of the outdoor unit is uncontrollable. 2) The network signal line of the outdoor unit is not connected properly or is disconnected. 3) The machine number of the outdoor unit is not set properly (an outdoor unit having the same machine number as that of the indoor unit is not present). 4) The circuit board of the outdoor unit is abnormal. 5) The outdoor unit is powered off or the CPU on the circuit board of the outdoor unit is uncontrollable. 6) The address number of the outdoor unit is not set properly.	1) Measure the supply voltage at the power terminal block of the outdoor unit. 2) Confirm power W, the power fuses, the power transformer, the power circuit board, and the outdoor unit circuit board. 3) Check if the outdoor signal lines are connected properly. 4) Check and, if necessary, correct the assigned indoor and outdoor unit address numbers. 5) Check and, if necessary, correct the assigned outdoor unit address numbers.

Alarm Code			Contents	Diagnosis and Repair	
Display of Remote Control Unit	Maintenance Board				
	Code	Sub-Code		Major Likely Causes	Diagnosis/Remedy
—	5	0	Communication error between the indoor and outdoor units	1) Improper connection of the outdoor unit signal line during operation (disconnected or loosened) 2) Communication error between the outdoor and indoor units due to noise or others 3) Power-off (interruption or out-of-phase) during the operation of the indoor and outdoor units driven by independent power supplies 4) Power supply cable disconnection of the outdoor unit circuit board or outdoor unit circuit board fault 5) Outdoor unit circuit board fault (the outdoor unit circuit board or CPU has become abnormal during the operation of the power supply)	1) Check for improper outdoor and indoor unit signal line connections. 2) Check the wiring route. 3) Shield the indoor and outdoor unit signal lines. 4) Measure the supply voltage at the power terminal block of the indoor and outdoor unit. 5) Confirm power W, the power fuses, the power transformer, the power circuit board, and the outdoor unit circuit board. 6) Check the outdoor unit circuit board.
—	50	0			
E5	—				
E6	96	?	Indoor heat exchanger temperature sensor wire disconnections	1) Indoor heat exchanger temperature sensor malfunction (defective element, wire disconnections) 2) Improper connection of the sensor connector 3) Indoor unit circuit board fault (heat exchanger sensor input circuit fault)	1) Confirm the connection of the indoor heat exchanger temperature sensor and sensor connector. 2) Confirm temperature display and compare an actual temperature value and the resistance value. 3) Check the indoor unit circuit board.
E7	97	?	Indoor intake temperature sensor wire disconnections	1) Indoor intake temperature sensor malfunction (defective element, wire disconnections) 2) Improper connection of the sensor connector 3) Indoor unit circuit board fault (sensor input circuit fault)	1) Confirm the connection of the indoor intake temperature sensor and sensor connector. 2) Confirm temperature display and compare an actual temperature value and the resistance value. 3) Check the indoor unit circuit board.
E9	95	?	Indoor unit drain water alarm	1) Check the drain piping. 2) Float switch malfunction 3) Drain pump fault, drain pump wire or connector disconnections	1) Check the pipe installation angle and start-up dimensions. 2) Check the float switch, float switch harness, and connectors (continuity: normal) 3) Check the drain piping.
E12	—		Addressing alarm	1) Mismatching of the address switch settings	1) For details refer to “3.1.2 Details of Address Setting Errors 1.2”.
E28	—		Remote control unit intake temperature sensor wire disconnections	1) Remote control unit sensor wire disconnections	1) Check the remote control unit sensor.

Alarm Code			Contents	Diagnosis and Repair	
Display of Remote Control Unit	Maintenance Board				
	Code	Sub-Code		Major Likely Causes	Diagnosis/Remedy
E43	43	0	Too many indoor units connected	13 indoor units or more are connected to one outdoor unit 1) 8-PS building-use multi-type: 13 units or more 2) 10-PS building-use multi-type: 13 units or more 3) 13-PS building-use multi-type: 13 units or more	Reviewing the number of indoor units which are connected 1) 8-PS building-use multi-type: 12 units or less 2) 10-PS building-use multi-type: 12 units or less 3) 13-PS building-use multi-type: 12 units or less
E56	94	?	Indoor heat exchanger temperature sensor short-circuiting	1) Indoor heat exchanger temperature sensor fault or short-circuiting 2) Harness short-circuiting	1) Confirm temperature display using the maintenance board. 2) Check if the indoor heat exchanger temperature sensor and related harness are short-circuited.
E31	31	0	Outdoor unit address overlapping	1) Outdoor unit address overlapping (U0 to U47) 2) Outdoor unit address number setting error	1) Check and, if necessary, correct the assigned outdoor unit addresses. 2) Check and, if necessary, correct the assigned outdoor unit address numbers.
—	4	0	Outdoor unit address number setting error		
E34	41	1	Less phase error	1) T phase of three-phase power supply is disconnected. 2) Mistaken power supply (sub-circuit connector)	1) Check the power supply wiring. 2) Check setting of power supply
—	41	1	Power supply connection error	- 1) In connection of three-phase power supply, the setting of power supply on the sub-circuit board is single.	1) Reconnect the connector.
—		2			
E36	91	0	Excessive increase in compressor air discharge temperature	1) Shortage of refrigerant, refrigerant flow channel clogging, compressor compression error 2) Improper heat release from condensing unit 3) Entry of non-condensed gas	1) Confirm the pipe temperature and pressure of the refrigerant system. 2) Confirm the amount of refrigerant (discharge temperature, refrigerant high-pressure value, and refrigerant low-pressure value). 3) Check the air filter for clogging in heating mode. 4) Confirm the operation of the hot-gas bypass valve, oil returning bypass valve, and four-way valve.
	91	2	Compressor air discharge temperature sensor alarm	1) Discharge temperature sensor fault or harness short-circuiting	1) Confirm temperature display using the maintenance board. 2) Check the discharge temperature sensor harness for short-circuiting. 3) Check the discharge temperature sensor connectors.
	91	3			

Alarm Code			Contents	Diagnosis and Repair	
Display of Remote Control Unit	Maintenance Board				
	Code	Sub-Code		Major Likely Causes	Diagnosis/Remedy
E38	61	1	Outside air temperature sensor wire disconnections	1) Outside air temperature sensor fault, wire disconnections, or improper connector connections 2) Outside air temperature sensor fault or short-circuiting	1) Check the temperature display. 2) Check the outside air temperature sensor and connector connections.
	61	0	Outside air temperature sensor short-circuiting		
E39	78	0	Compressor discharge temperature sensor wire disconnections	1) Discharge temperature sensor fault, wire disconnections or improper connector connections	1) Check the temperature display. 2) Check the discharge temperature sensor and connector connections.
	78	1			
E40	76	0	Refrigerant high-pressure switch wire disconnections	1) High-pressure switch malfunction 2) Harness wire disconnections or improper connector connections	1) Check the refrigerant high-pressure switch. 2) Confirm harness continuity and connector connections.
	86	0	Refrigerant high-pressure alarm	1) Improper heat release from condensing unit 2) Refrigerant circuit malfunction (such as a blocked or overfilled status)	1) Check for clogging of the heat exchanger near the condenser, and for abnormal operation of the fan. 2) Check the refrigerant system (check for refrigerant leakage, clogging, etc.) using refrigerant system diagrams A, B, D, and Q.
E52	72	0	Engine room temperature sensor wire disconnections	1) Engine room temperature sensor fault, or improper connector connections 2) Engine room temperature sensor fault or short-circuiting 3) Discharge temperature sensor fault or improper connector connections	1) Confirm temperature display (compare an actual temperature value and the resistance value). 2) Confirm engine room temperature sensor and connector connections. 3) Confirm exhaust temperature sensor and connector connections.
	72	1	Engine room temperature sensor short-circuiting		
	72	6	Exhaust air temperature sensor disconnections		
E53	53	0	Compressor intake temperature sensor wire disconnections	1) Compressor intake temperature sensor fault 2) Compressor intake temperature sensor harness wire disconnections 3) Improper connector connections 4) Compressor intake temperature sensor harness short-circuiting	1) Confirm temperature display using the maintenance board. 2) Check for the harness wire disconnections. 3) Check for improper connector connections. 4) Check for harness short-circuiting.
	53	2	Compressor intake temperature sensor short-circuiting		
E54	63	0	Accumulator inlet temperature sensor wire disconnections	1) Accumulator inlet temperature sensor fault, wire disconnections, or improper connector connections 2) Accumulator inlet temperature sensor fault or short-circuiting	1) Confirm temperature display (compare an actual temperature value and the resistance value). 2) Confirm the accumulator inlet temperature sensor and connector connections.
	63	1	Accumulator inlet temperature sensor short-circuiting		

Alarm Code			Contents	Diagnosis and Repair	
Display of Remote Control Unit	Maintenance Board				
	Code	Sub-Code		Major Likely Causes	Diagnosis/Remedy
E55	64	0	Gas pipe temperature sensor wire disconnections	1) Gas pipe temperature sensor fault, wire disconnections, or improper connector connections 2) Gas pipe temperature sensor fault or short-circuiting	1) Confirm temperature display (compare an actual temperature value and the resistance value). 2) Confirm gas pipe temperature sensor and connector connections.
	64	1	Gas pipe temperature sensor short-circuiting		
E57	88	0	Refrigerant low-pressure alarm	1) Improper heat release from evaporator unit 2) Refrigerant circuit malfunction (such as a blocked or overfilled status)	1) Check for clogging of the heat exchanger near the evaporator, and for abnormal operation of the fan. 2) Check the refrigerant system (check for refrigerant leakage, clogging, etc.) using refrigerant system diagrams A, B, D, and Q.
	88	2	Refrigerant low-pressure switch wire disconnections	1) Low-pressure switch malfunction 2) Harness disconnections or connector disconnections	1) Check the refrigerant low-pressure switch. 2) Confirm harness continuity and connector connections.
	88	5	No refrigerant	1) Refrigerant leakage from the flare connection and others 2) Pressure sensor malfunction	1) Refrigerant leakage 2) Malfunction of pressure sensor or low-pressure switch
E58	47	0	Exhaust temperature alarm	1) Deodorization agent clogging	1) Check the deodorization agent
E80	80	0	Engine coolant too hot	1) Coolant circulation error 2) Heat release insufficient 3) Sensor malfunction 4) Short-circuiting due to contact of the coolant sensor harness with the body 5) No-load operation without added coolant	1) Check if the coolant level in the reservoir tank is between F and L. Also, check the thermostats and the thermovalves. 2) Confirm the temperature differences between A-B and C-D connections per the coolant system diagram (Cooling: 7 to 10 °C, Heating: 10 to 15 °C). 3) Check for clogging of the radiator and for abnormal operation of the coolant pump and outdoor unit fan. 4) Check the coolant temperature sensor. 5) Check the harness connector.
	80	1	Engine coolant temperature sensor wire disconnections		
	80	2	No engine coolant		
E81	81	0	Engine oil pressure alarm	1) Oil pressure too low (or oil level too low or others)	1) Check the oil level (the oil level must be between F and L on the oil level gauge). 2) Check the oil pressure switch and harness.
E82	82	0	Engine speed too high alarm	1) Stepping motor malfunction or others	1) Confirm the stepping motor coil resistance value. 2) Check connector and harness connections.
	82	1			

Alarm Code			Contents	Diagnosis and Repair	
Display of Remote Control Unit	Maintenance Board				
	Code	Sub-Code		Major Likely Causes	Diagnosis/Remedy
E83	60	0	Starter alarm	1) Fusing of the starter driving relay inside the control box 2) Outdoor unit circuit board malfunction	1) Confirm whether, when the starter is turned off, 12 VDC is applied to the starter pinion coil. 2) Confirm whether, when the starter is turned off, 12 VDC is applied to the starter driving relay.
	74	1	Engine starting speed alarm	1) Starting motor malfunction 2) Connector disconnections 3) Pickup coil wire disconnections	1) Check the starting motor. 2) Check the starting motor, pinion connector, and pinion harness. 3) Check the pickup coil. 4) Check the outdoor unit circuit board.
	74	4	Engine speed control alarm	1) Connector disconnections	1) Make sure that connector CN10 (I) is not disconnected. 2) Make sure that connector CN33 (X) is not disconnected. 3) Check the outdoor unit circuit board.
	74	7	Gas electro-magnetic valve output alarm	1) Gas electromagnetic valve output error	1) Check the outdoor unit circuit board.
E84	84	0	Engine start alarm	1) Fuel circuit malfunction 2) Ignition circuit malfunction 3) Improper compression	1) Check the gas-operated solenoid valve and the regulator. 2) Check the ignition plugs (plug gap: 0.4 to 0.1 mm) and the high-tension cords. 3) Confirm compression (at least 12.0 kg/cm^2) and check the O2 level. 4) Check the clearances (INO. 35 mm, EXO. 0.35 mm).
	75	0	Engine stop		
E85	44	?	Indoor unit mismatch	1) Insufficiency in engine output 2) Stepping motor malfunction or others	1) Confirm compression (at least 11.0 kg/cm^2) and check the O2 level. 2) Check the stepping motor.
E86	71	0	Engine oil pressure switch wire disconnections	1) Oil pressure switch malfunction 2) Harness wire disconnections or connector disconnections	1) Check the oil pressure switch. 2) Confirm harness continuity and connector connections. 3) Confirm that the output of the starter capacitor is 12 V (if necessary, retighten the plus and minus terminals).
E87	70	0	Engine coolant temperature sensor wire disconnections	1) Engine coolant temperature sensor wire disconnections 2) Harness wire disconnections or connector disconnections	1) Check the coolant temperature sensor. 2) Confirm harness continuity and connector connections.
—	74	6	Engine speed hunting alarm	1) Engine speed hunting alarm	1) Check the fuel gas pressure. 2) Check the engine speed sensor. 3) Check the engine speed sensor for improper contact 4) Check the outdoor unit circuit board.
—	84	3	Engine microcomputer communications error	1) Engine microcomputer communications error	1) Check the outdoor unit circuit board.

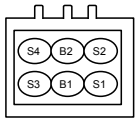
Alarm Code			Contents	Diagnosis and Repair	
Display of Remote Control Unit	Maintenance Board				
	Code	Sub-Code		Major Likely Causes	Diagnosis/Remedy
—	84	4	Engine program writing alarm	1) Engine program writing error	1) Check the outdoor unit circuit board.
E89	65	0	Outdoor heat exchanger liquid temperature sensor wire disconnections	1) Outdoor heat exchanger liquid temperature sensor malfunction, wire disconnections or improper connector connections	1) Confirm temperature display using the maintenance board. 2) Check the outdoor heat exchanger liquid temperature sensor for wire disconnections and improper connections.
	65	2	Outdoor heat exchanger liquid temperature sensor short-circuiting	1) Outdoor heat exchanger liquid temperature sensor malfunction or short-circuiting	1) Confirm temperature display using the maintenance board. 2) Check the outdoor heat exchanger liquid temperature sensor and harness short-circuiting.
	73	0	Refrigerant high-pressure sensor alarm	1) High-pressure sensor mal-function or short-circuiting	1) Confirm pressure display using the maintenance board. 2) Check the high-pressure sensor and harness short-circuiting.
	73	1		1) High-pressure sensor mal-function, cord disconnections or connector disconnections	1) Confirm pressure display using the maintenance board. 2) Check for wire disconnections of the high-pressure sensor and harness and for improper connections of the connector.
	87	0	Abnormal increase in compressor intake temperature	1) Four-way changeover valve stalled in the middle 2) Hot-gas bypass valve malfunction	1) Check the temperatures of the four-way changeover valve and periphery. 2) Check the operation of the hot-gas bypass valve.
—	70	5	Fault in motor-driven three-way valve hole IC	1) Fault in motor-driven three-way valve hole IC	1) Check the output of the motor-driven three-way valve hole IC. 2) Check for wire disconnections and improper contact of the harness. 3) Check the outdoor unit circuit board.
—	40	0	EEPROM error	1) EEPROM error	1) Check the outdoor unit circuit board.
—	3	0	Indoor unit not connected	1) The setting of the outdoor unit address at the indoor unit side is not correct. 2) Despite the indoor/outdoor unit independent power specifications, the indoor unit is powered off.	1) Confirm and review the setting of the addressing switch. 2) Perform indoor unit power checks and reviews.
E61	93	?	Mode mismatch	Mode mismatch	1) Check the setting of the remote-controlled operation mode.

Details of Address Setting Errors (1.2)

Type or Addressing	Outdoor Unit Switch (Outdoor No.)	Indoor Unit Switch		Alarm Display		Address Setting Status
		Outdoor No.	Indoor No.	Code	Unit	
Automatic	49	49, 48	0 to 47	E12	U49	Addressing error
		0 to 47	0 to 47	E3, E46	U0 to U47	Pairing error
		0 to 47	49, 48	E12	U49	Addressing error
Manual	0 to 48	0 to 47	49, 48	E12	U49	Addressing error
		49, 48	0 to 47	E12	U49	Addressing error
By remote control unit	0 to 48	49, 48	49, 48	—	—	Not to be used

Notes:
1. Automatic addressing settings are not stored into memory when E12 is displayed.
2. E3 is displayed for the indoor units whose automatic address settings have already been stored into memory.
3. The unit numbers listed above are for reference only.

3. 3 Diagnostic Items

	Check Item	Section To Be Measured	Normal Voltage	Normal Resistance	Remarks
Main unit	Power circuit breaker (ELB) Power terminal (TB1) Outdoor unit circuit board	Red - White 1 2 Red - White R S CN18 - 1 (Red) - 2 (White)	200 VAC		
	Ventilation fan (EFAN)	CN14 - 3 (White) - 10 (Black)	200 VAC	170 Ω	
	Fan motors 1 and 2 (FM1, FM2)	Fan 1: CN13-2, 7 Fan 2: CN13-3, 4, 8	200 VAC	Single-speed type (FM1) White-Black 24.6Ω±10% Black-Yellow 60.9Ω±10% Two-speed type (FM2) White-Black 24.6Ω±10% Orange-Red 35.2Ω±10% Red-Black 27.5Ω±10%	
	Outside air temperature sensor (THO)	CN6 - 15, 16 (White)		–20°C..... 39.58 kΩ –10°C..... 23.95 kΩ 0°C..... 15.00 kΩ 10°C ..... 9.58 kΩ 20°C ..... 6.43 kΩ 30°C ..... 4.21 kΩ 40°C ..... 3.04 kΩ	- Unconnected wire detection temperature below –39°C is detected continuously for one min. (Outside air temperature sensor wire disconnections: E38) (Engine room temperature sensor wire disconnections: E52) - Short-circuiting detection temperature above 90°C is detected continuously for one min. (Outside air temperature sensor short-circuiting: E38) (Engine room temperature sensor short-circuiting: E52)
	Engine room temperature sensor (E/GR)	CN6 - 13, 14 (Red)			
Engine	Throttle valve (STM)	CN11-9 to 14	Pulse waveform at –30 to + 30 VDC		
	Engine oil pressure switch (OLP)	CN8 Brown - Yellow 17 18	ON: 1 VDC or less OFF: 11 - 13 VDC	1 Ω or less 1 MΩ or more	The oil pressure is abnormal for three sec or more.
	Gas electro-magnetic valve 1 (GV1)	CN7 White - White 19 20	10 - 16 VDC (14 VAC full-wave rectification)	21 Ω	
	Gas electro-magnetic valve 2 (GV2)	CN7 Black - Black 17 18			
	Starter (STR)	Motor plus terminal - Ground	11 - 19 VDC		
	Starter pinion coil	Starter relay output terminal or starter pinion terminal - Ground	11 - 13 VDC		
	Digital igniter (controller) (IGN)	IGN-H, C	12 VDC		
	Fuel gas regulating valve (FUEL)	CN11 - 3 (Yellow) - 1 (White) - 5 (Orange) - 4 (Red) - 7 (Blue) - 6 (Red)	–30 to +30 VDC	B1 - S1 B1 - S3 B2 - S2 } 32 ± 2 Ω B2 - S4 S1 - S3 S2 - S4 } 64 ± 4 Ω 	
	Coolant heater (E/G WH) (Option)	CN13 - 1, 6 (Blue)	200 AVC	160 Ω ± 12 Ω	

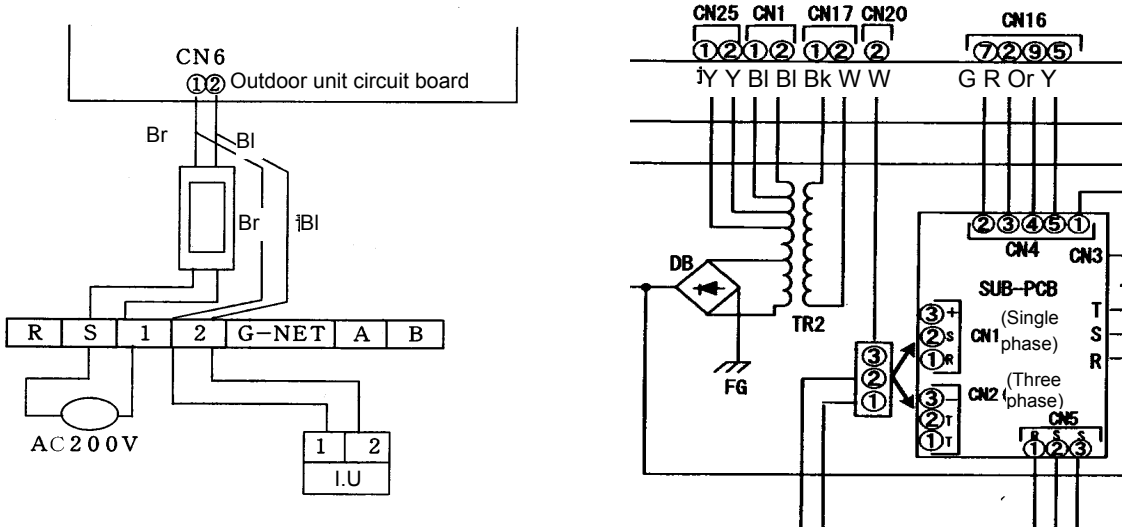
	Check Item	Section To Be Measured	Normal Voltage	Normal Resistance	Remarks
Engine	Exhaust temperature sensor (E/G E) (Option)	CN7 - 13, 14 (Yellow)		(Room temp.) ..... Continuity 200°C..... 371100 Ω 300°C..... 52600 Ω 400°C..... 11500 Ω 500°C..... 3529 Ω 600°C..... 1378 Ω 700°C..... 637.6 Ω 800°C..... 342.0 Ω	
	Outboard 12-V power supply	CN26 - 1 (Red) - 2 (Black)	12 VDC		
	Exhaust drain heater (DH) (Only for Winterized type)	CN14 - 13 (Black) - 7 (White)	200 VAC	1.33 kΩ ± 15%	
Coolant circuits	Coolant temperature sensor (WT)	CN7 - 9 (Black) - 12 (White)		50°C ..... 17.6 kΩ 80°C ..... 6.1 kΩ 100°C..... 3.3 kΩ 110°C..... 2.5 kΩ	- Coolant temperature of 105°C or more is detected for 10sec (Abnormal engine coolant temperature: System shutdown) - Coolant temperature below 0°C is detected for three min when Engine RPM is 700rpn or more. during operation. (Engine coolant temperature sensor wire disconnections: System shutdown)
	Coolant pump (WP)	CN13 - 5 (Black) - 9 (White)	200 VAC	58.4 kΩ ± 10%	
	Motor-driven three-way valve (EWV)	CN10 - 9 (Brown) - 10 (Black) - 11 (Blue) - 13 (Orange) - 14 (White) - 15 (Yellow) CN8 - 5 (Green) - 6 (Red)	11 to 13 VDC	Brown - White 36 Ω Orange - White 36 Ω Blue - White 36 Ω Yellow - White 36 Ω	
Refrigerant circuits	Discharge temperature sensors R and L (C/P TR) (C/P TL)	R: CN6 - 7, 8 L: CN6 - 5, 6		0°C..... 182.9 kΩ 20°C ..... 70.4 kΩ 50°C ..... 20.2 kΩ 80°C ..... 7.0 kΩ 100°C..... 3.7 kΩ 120°C..... 2.1 kΩ	- Wire disconnection detection temperature below 5°C is detected for ten min. (Discharge temperature sensor wire disconnections: E39) - Short-circuiting temperature above 120°C is detected for one min. (Discharge temperature sensor short-circuiting: E36)
	High-pressure switch (HL SW)	CN8 - 3 (Black) - 4 (Black)	OFF: 11 - 13 VDC ON: 1 VDC or less	1 MΩ or more 1 Ω or less	- Error detection at a high pressure of 2.75 MPa (OFF) - Return to normal at 2.16 MPa (ON)
	High-pressure sensor (HS)	CN7 - 8 (Red) - 4 (Black)	5 VDC ± 0.5 V	Output voltage CN7 White - Black 3 4	(MPa) 3.0 2.0 1.0 0 0.5 1 2 3 3.5 Output voltage (V) The output voltage value is about 1 V for 1 MPa.
	Low-pressure switch (LLSW)	CN8 - 1 (Black) - 2 (Black)	OFF: 11 - 13 VDC ON: 1 VDC or less	1 MΩ or more 1 Ω or less	- Error detection at a low pressure of 0.05 MPa (OFF) - Return to normal at 0.15 MPa (ON)

	Check Item	Section To Be Measured	Normal Voltage	Normal Resistance	Remarks
	Liquid flow regulating valve (EV1) (Electronic expansion valve)	CN10 - 1 (White) - 2 (Red) - 3 (Yellow) - 4 (Brown) - 5 (Orange) - 7 (Blue)	11 - 13 VDC	Red - White (5-6) Red - Orange (5-3) Brown - Yellow (2-4) Brown - Blue (2-1) .....150 Ω ± 10% White - Orange (6-3) Yellow - Blue (4-1) .....300 Ω ± 20%	
Refrigerant circuits	Oil returning valves 1 and 2 (OILB1) (OILB2)	1: CN15 - 9 (Red) - 17 (Red) 2: CN15 - 8 (Purple) - 16 (Purple)	200 VAC	1.2 kΩ	
	Heat exchanger liquid temperature sensor (THL)	CN6 - 1, 2 (White)		–10°C....24.0 kΩ 0°C.....15.0 kΩ 10°C ....9.7 kΩ 20°C ....6.4 kΩ 30°C ....4.3 kΩ 40°C ....3.0 kΩ 50°C ....2.2 kΩ 55°C ....1.83 kΩ 60°C ....1.56 kΩ 65°C ....1.34 kΩ 70°C ....1.15 kΩ 75°C ....0.99 kΩ	- Wire disconnection alarm when temperature of less than –39°C is detected continuously for one min. - Short-circuiting alarm when temperature of 90°C or more is detected continuously for one min. - Alarm codes for short-circuiting: E37, E55, E54
	Gas pipe temperature sensor (GAS)	CN6 - 9, 10 (White)			
	Intake temperature sensor (C/P SR)	CN6 - 11, 12 (White)			
	Accumulator inlet temperature sensor (AIN)	CN6 - 3, 4 (White)			
	Hot gas bypass valve (BV)	CN14 - 1, 8 (Purple)	200 VAC	800 Ω	
	Compressor clutches R and L (C/P R, C/P L)	R: CN12-2 L: CN12-1	11 - 13 VDC	4 Ω ± 20%	
	Four-way changeover valve (4PV)	CN15 - 2, 11 (Black)	200 VAC	1.3 kΩ ± 20%	
	Capacity regulating valve (C/P FV)	CN10 - 17 (White) - 18 (Red) - 19 (Yellow) - 20 (Brown) - 21 (Orange) - 23 (Blue)	11 - 13 VDC	Red - White (5-6) Red - Orange (5-3) Brown - Yellow (2-4) Brown - Blue (2-1) .....150 Ω ± 10% White - Orange (6-3) Yellow - Blue (4-1) .....300 Ω ± 20%	
Indoor unit circuits	Indoor unit temperature sensor (THI-A)	On indoor unit circuit board CNH 1 - 2		–10°C..... 29.1 kΩ 0°C..... 16.8 kΩ 10°C ..... 10.8 kΩ 20°C ..... 6.2 kΩ 30°C ..... 4.0 kΩ 40°C ..... 2.6 kΩ 50°C ..... 1.8 kΩ	- Unconnected jumper detection temperature (–40°C) is detected continuously for 5 sec. (Indoor unit temperature sensor wire disconnections: E7) - Unconnected jumper detection temperature (–40°C) is detected continuously for 5 sec. (Indoor heat exchanger sensor disconnections: E6)
	Indoor heat exchanger temperature sensor (THI-R)	CNH 3 - 4			
	Float switch (FS)	FASTON terminal 9 - 5 (On indoor unit circuit board)	OFF: 200 VAC ON: 10 VAC or less		- Drain pump is operated - Float switch OFF is detected - Compressor ON in cooling and dehumidifying (operated for 2min after compressor off)

3.4 Trouble Diagnosis and Check

3.4.1 If the System Does Not Operate

Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
The system does not operate. No data is displayed on the panel of the remote control unit.	1) Faults in the power circuits	- Incorrect power line wiring - Wire disconnections or incomplete contact - Control circuit fault - Tripped ground leakage circuit breaker	- See "(1) Checking the power circuits". - See "(2) Checking the control section". - See "(3) Diagnosing for current leakage".
	2) Faults in the remote control circuit	- Wire disconnections or incomplete contact - Fault in the remote control unit	- See "(4) Checking the remote control circuit".
Data is displayed on the panel of the remote control unit, but the system does not operate.	3) Faults in the communications circuit	- Incorrect communications line wiring - Wire disconnections or incomplete contact - Incorrect DIP switch settings - Incorrect wiring - Wire disconnections or incomplete contact - Control circuit fault	- Check the communications lines for disconnections and internal short-circuiting. - See "(5) Checking the DIP switches". - See "(2) Checking the control section".



(1) Checking the power circuits

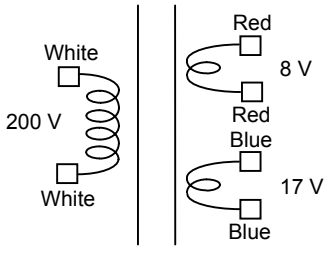
[1] Check that the power lines of the indoor and outdoor units are connected properly in accordance with the installation manual.

[2] Check that a supply voltage of 200 VAC is applied to the power terminals of the indoor and outdoor units.

(2) Checking the control section

[1] Outdoor unit
If the green LED on the circuit board does not blink in spite of 200 VAC being applied, the power transformer or the power board is likely to be malfunctioning. Confirm the input and output voltages.

[2] Indoor unit
Similarly, confirm the input and output voltages of the indoor unit transformer as well. If 200 VAC is not applied, there may be a broken fuse(s).



(3) Diagnosing for current leakage

If the ground leakage circuit breaker trips, measure insulation resistance values using a megohmmeter and diagnose for current leakage.

Leakage diagnosing procedure

[1] Checking the 200-V units
If the resistance value can be recovered by disconnecting the CN1, CN2, and CN4 connectors from the outdoor unit circuit board, current is leaking from either of these connections. Check each unit independently.

[2] Checking the indoor units
If the resistance value can be recovered by disconnecting the power terminals from the terminal blocks of each indoor unit, current is leaking from either indoor unit.

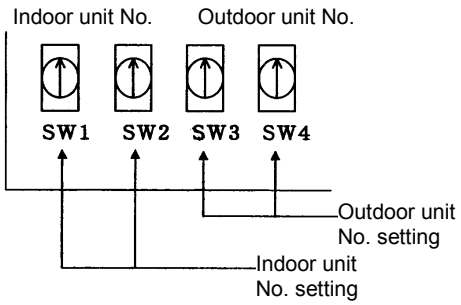
Note:
Do not connect the megohmmeter to the communications circuits.

(4) Checking the remote control circuit

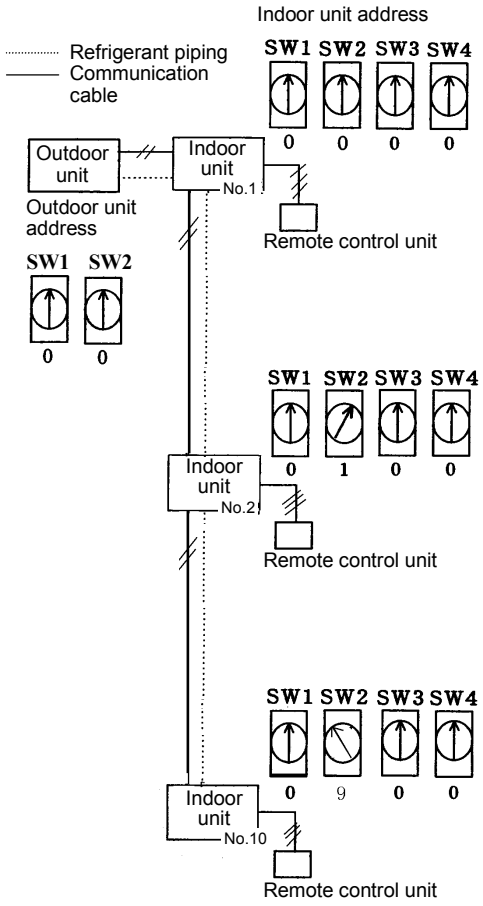
Check the terminals of the indoor units and remote control unit for incomplete electrical contact and for wire disconnections.

(5) Checking the DIP switches

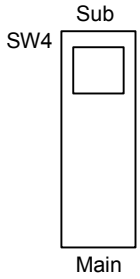
Check the DIP switches of the indoor and outdoor units and remote control unit for incorrect settings.



Example of DIP switch setting



Setting of the slide switch of the remote control unit



3.4.2 If the Starter Does Not Operate

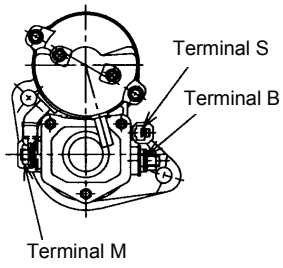
Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
E83 (74) display Engine starting failure	The starter does not operate.	[1] Starter pinion does not operate ├ Pinion driving coil malfunction └ No output [2] Starting motor and pinion do not operate ├ Starting motor malfunction └ No output	- See "(1) Checking the starter".
		The starter driving circuit is likely to be malfunctioning if neither the pinion coil nor the starting motor develops an output voltage.	
		[3] Starter driving circuit malfunction ├ Transformer └ Relay malfunction	- See "(2) Checking the transformer". - See "(3) Checking relays for normal operation".

(1) Checking the starter

[1] Checking the output voltage to the starter

– Output voltage to the starting motor
Check that an output voltage of 12 VDC is applied between the terminal B and body of the starting motor during the operation of the ventilation fan.

– Output voltage to the pinion driving coil
Check that when the starting motor lamp on the maintenance board is on, an output voltage of 12 VDC is applied between the terminal S and body of the starting motor.



[2] Checking the starter

Measuring Sections	Reference Resistance Value at 20°C
Terminal S – Body ground	0.24 Ω
Terminal B – Body ground	∞
Terminal M – Body ground	0.01 Ω
Terminal S – Terminal M	0.24 Ω
Terminal S – Terminal B	∞
Terminal B – Terminal M	∞

(2) Checking the transformer

[1] Checking the secondary output voltage
Check that an output voltage of 12 VAC is applied between the primary terminal of the diode and the frame ground during the operation of both the ventilation fan and the coolant pump and stoppage of the starter.

[2] Checking the primary input power
Check that a voltage of 200 VAC is applied during the operation of both the ventilation fan and the coolant pump.

The transformer may be malfunctioning if, despite the primary input voltage being normal, the secondary output voltage is abnormal.

[3] Checking the transformer unit
Check for primary/secondary coil disconnections and for internal short-circuiting.

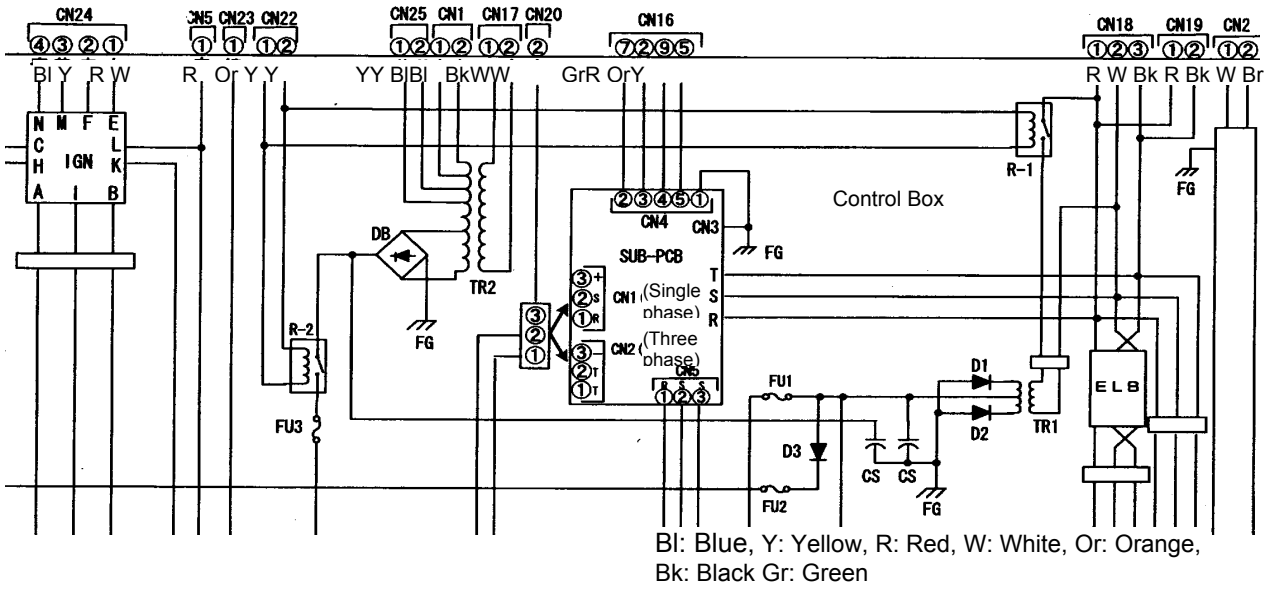
(3) Checking relays for normal operation

(See the reference diagram below.)

[1] Relay R-1 turns on at the same time the motor becomes ready for operation (the coolant pump and the ventilation fan start operating). Therefore, make sure at this time that 12 VDC is applied between terminals 1 and 2. Also, check the relay coil and verify electrical continuity between terminals 1 and 2.

[2] Relay R-3 turns on during the start of the starter. Make sure that 12 VDC is applied between terminals 1 and 2 during starter start. Also, check the relay coil and verify electrical continuity between terminals 1 and 2.

Starting motor driving circuits (Reference diagram)



Bl: Blue, Y: Yellow, R: Red, W: White, Or: Orange, Bk: Black Gr: Green

Description of operation

(1) After the OPERATE switch has been turned on, 12 VDC is applied between CN22 connector terminals 1 and 2 on the control circuit board at the same time the ventilation fan and the coolant pump operate, and thus R-1 is activated.
(2) When R-1 is turned on, 200 VAC is applied to the primary side of the transformer TR1.
(3) After rectification between the secondary side of the transformer and the diodes, a voltage of 11 to 19 VDC is applied to the plus terminal of the starting motor.
(4) 12 VDC is output from the CN21 connector terminals 1 and 2 on the control circuit board, then R-3 is turned on, and 11 to 13 VDC is applied to the starter pinion coil to activate the starter.

3.4.3 If the Engine Does Not Start

Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
E83 (74) display E84 (84) display Engine starting failure	1) Intake/ exhaust circuit faults	[1] Fuel gas └ Gas valve does not open ┬ Gas valve malfunction └ No output	- See "(1) Checking the gas electromagnetic valves".
		[2] Significant A-F ratio changes ├ Air circuit ┬ Air intake port clogging └ Air cleaner clogging └ Fuel circuit ┬ Leakage from gas regulator └ Mixer malfunction	- Check and, if necessary, replace the air cleaner. - See "(2) Checking the gas regulator". - Check and, if necessary, replace the mixer. See "(9) Mixer fuel valve check" and "(2) Checking the throttle actuator" in 3.3.4.
		[3] Exhaust circuit clogging ├ Drain water freezing ─ Drain hose freezing └ Exhaust heat exchanger or muffler clogging	- Install a drain heater.
	2) Ignition circuit faults	[1] Plug malfunction ┬ Deposits or moisture └ Plug gap out of specs.	- See "(3) Checking the ignition plugs".
		[2] Ignition failure ┬ Cap or connector disconnections ├ High-tension cord malfunction ├ Igniter malfunction └ No output	- See "(4) Checking the high-tension cords". - See "(5) Checking the igniter".
		[3] Ignition timing error	- See "(1) Checking and adjusting ignition timing" in 3.3.4.
	Improper compression is likely if the crankshaft can be readily rotated by hand without resistance.		
	3) Compressor circuit faults	[1] Upward valve plunging └ Valve clearance error	- See "(6) Checking for appropriate compression". - See "(7) Valve clearance check and adjustment".
		[2] Valve caught in the mechanism	- See "(8) Improving incomplete compression due to an obstruction on the valve seat".

(1) Checking the gas electromagnetic valves

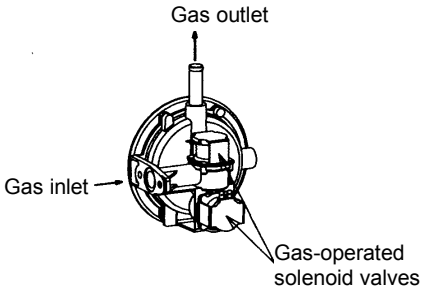
[1] Checking the output voltage
Check the maintenance board and the outdoor unit circuit board and make sure that an output voltage of 12 VDC is supplied.
If, in spite of the fact that the corresponding LED is on during the check mode of the maintenance board, the required output voltage is not supplied, the switching circuit on the board is likely to be faulty.

[2] Checking the gas electromagnetic valve body
Disconnect the connector from the gas valve. Next, check the two electromagnetic valves for continuity between the respective terminals and scan for electromagnetic coil disconnections.

Reference resistance value: 21 Ω

(2) Checking the gas regulator

Disconnect the fuel gas hose, then start the engine, and make sure that when the gas electromagnetic valves operate, the fuel gas does not leak from the gas regulator outlet pipe.
If the fuel gas leaks, the gas regulator is malfunctioning.
If gas injection from the inlet does not result in gas leakage and the gas is taken in smoothly from the outlet, the gas regulator is normal.



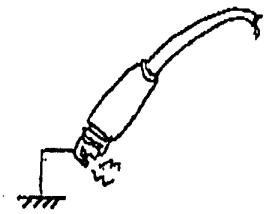
(3) Checking the ignition plugs

– Checking each ignition plug for sparking

[1] Remove the ignition plug and close the main gas plug.

[2] After inserting the ignition plug into the high-tension cord, bring the plug body into contact with the engine body.

[3] Press the OPERATE switch and check that the engine will crank and that sparks will be generated.



The above check can be performed by operating the starting motor alone for 5 seconds in the component check mode of the maintenance board. (Check mode: “31”)

– Checking the ignition plug electrodes
Check each plug for thermally or physically damaged, dirty, or unusually worn electrodes.

Reference electrode gap: 0.4 to 1.0 mm

Note:
To remount the plug, hand-tighten it first and then retighten to a 20 to 25 N·m torque using a plug wrench.

(4) Checking the high-tension cords

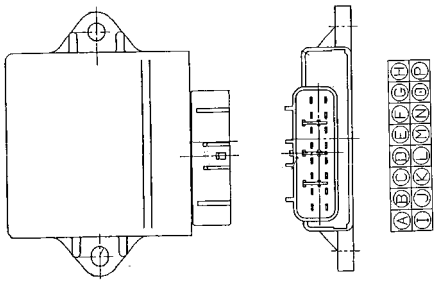
[1] Make sure that each high-tension cord is fully inserted.

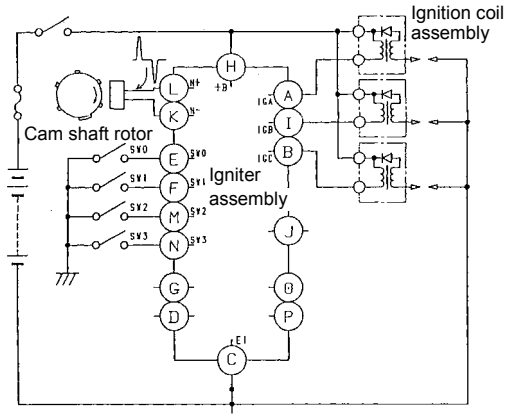
[2] Internal cord disconnections check
Verify that the resistance values of the high-tension cord terminals are as listed below.

#1	5.7 ± 2.2	kΩ
#2	4.6 ± 1.8	
#3	3.5 ± 1.3	

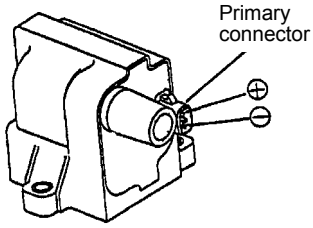
(5) Checking the igniter

[1] Checking the output voltage of the igniter
Make sure that the corresponding LED on the maintenance board is on and that an output voltage of 12 VDC is developed between the E1 (B) terminal and +B (A) terminal of the igniter.
The above check can be performed by switching on the igniter alone for 3 minutes in the component check mode of the maintenance board. (Part code: “02”)





[2] Checking the ignition coils
Check the primary and secondary ignition coils for disconnections and short-circuiting.



Reference resistance value: 2.8 Ω ± 10% (20°C)

[3] Checking the cam angle sensor
Confirm the resistance value between both terminals of the cam angle sensor.

Resistance value: 1100 ± 150 Ω (20°C)

(6) Checking for appropriate compression

Measure the compression pressure of each cylinder using a compression pressure gauge to achieve the required engine output. The procedure is as follows:

[1] Remove the ignition plug.

[2] Insert and firmly screw down section **5** of adapter **4** into the plug hole.

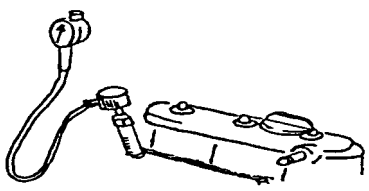
[3] Fully rotate section **3** in the direction of the arrow as far as **3** can go. The rubber piece of section **5** will be firmly pressed against the plug hole and fixed.

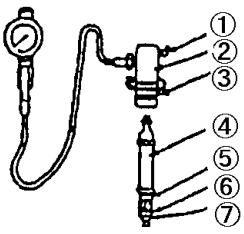
[4] Mount a pressure gauge at a sufficient distance from all movable sections.

[5] Crank the engine by pressing the OPERATE switch and measure the compression pressure of the cylinder.
After selecting the check mode with the maintenance board functions and then turning on the transformer power, the above check can be performed by turning on the starter and letting it operate independently for 5 seconds. (Part code: “01”)

[6] Reset the needle to zero by pressing section **1**, and perform similar measurements for other cylinders as well.

<Compression pressure gauge>





Reference value: 1.4 MPa or more

(7) Valve clearance check and adjustment

[1] Remove the head cover.

[2] Match the crank pulley to the top dead center mark as shown in the right view.

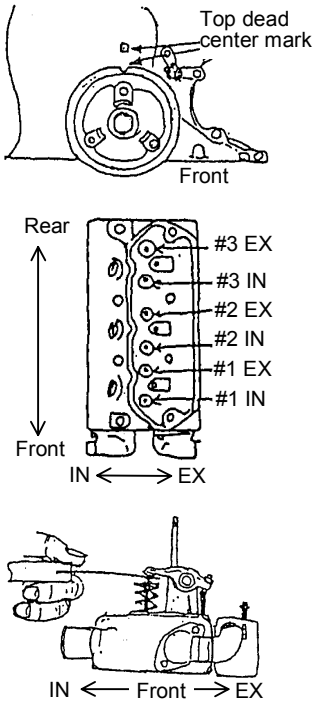
[3] Make sure that when the crank pulley is rotated by about 20 degrees horizontally, the IN (intake) rocker arm of the #1 cylinder does not move. If the rocker arm moves, rotate the crank pulley through one full turn for matching to the top dead center.

[4] Loosen the adjust nuts on the #1 and #3 intake cylinders and the #1 and #2 exhaust cylinders as shown, and adjust each cylinder.

[5] Rotate the crank pulley through 360 degrees.

[6] Loosen the adjust nuts on the #2 intake cylinder and the #3 exhaust cylinder as shown, and adjust both cylinders.

Reference Value	0.35 ± 0.05 mm	Hot status
	0.25 ± 0.05 mm	Cold status



(8) Improving incomplete compression due to an obstruction on the valve seat

If carbon gets caught on the surface of the valve seat, clear this abnormal state by cleaning with a valve cleaner as follows:

[1] Remove the ignition plugs and the air hose of the mixer.

[2] Disconnect the igniter connectors from the control box.

[3] Open the head cover, and rotate the crankshaft to where the clearances corresponding to the #1 and #3 IN cylinders can be adjusted.

[4] Open the throttle valve of the mixer by an angle of 493 steps (fully open) using the maintenance function of the maintenance board.

[5] Protect each plug hole with a waste cloth.

[6] After injecting a valve cleaner from the hole in the mixer for about 20 seconds, leave the hole intact for about 10 minutes.

[7] Manually rotate the engine pulley through one full turn.

[8] Close the head cover, and crank the engine by activating the starter (use the maintenance function of the maintenance board).

[9] Open the head cover, and rotate the crankshaft to where the clearance corresponding to the #2 IN cylinder can be adjusted.

[10] Repeat steps [4] to [8] above.

[11] Remount the ignition plugs, the air hose, and the igniter connectors.

[12] Disconnect the mixer - head cover blowby hose from the head cover, and start the engine.

[13] Inject about a half can of valve cleaner from the disconnected blowby hose into the mixer. Perform the injection intermittently with care so as not to allow the engine to stall or to overspeed.

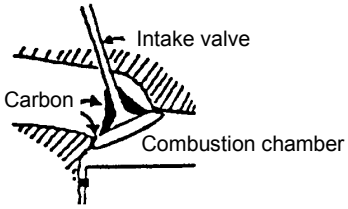
⚠ WARNING

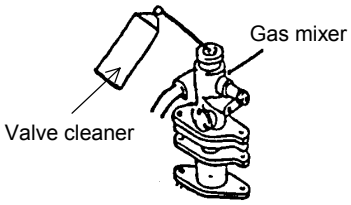
When the engine is running, be extra careful so as not to get your body or clothes caught in movable sections such as pulleys.

[14] Reconnect the hose and then after letting the engine run until no white smoke has come out from the exhaust trapper, stop the engine.

[15] Confirm compression. If compression is not recovered, repeat steps [1] to [11] above.

Cleaning with a valve cleaner





[1] Disconnect the mixer - T pipe blowby hose from the T pipe.

[2] Start the engine.

[3] Inject about a half can of valve cleaner from the disconnected blowby hose into the mixer. Perform the injection intermittently with care so as not to allow the engine to stall or to overspeed.

[4] Reconnect the hose.

[5] Let the engine run until no white smoke has come out from the exhaust trapper, and then stop the engine.

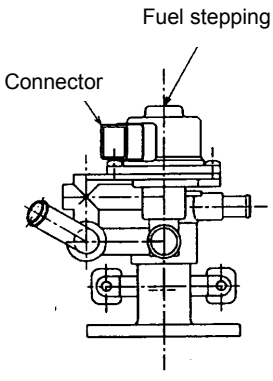
⚠ WARNING

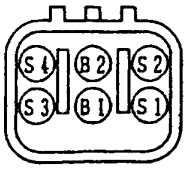
Be extra careful so as not to get your fingers, clothes, etc. caught at the pulley or other rotating bodies when cleaning.

(9) Mixer fuel valve check

Remove the fuel valve harness from the mixer and confirm the resistance values between each connector terminal connection on the stepping motor.

Terminal	Resistance between Terminals (20°C)
B1 – S1	32 ± 2 Ω
B1 – S3	32 ± 2 Ω
B2 – S2	32 ± 2 Ω
B2 – S4	32 ± 2 Ω
S1 – S3	64 ± 4 Ω
B2 – S4	64 ± 4 Ω





3.4.4 If the Engine Stalls

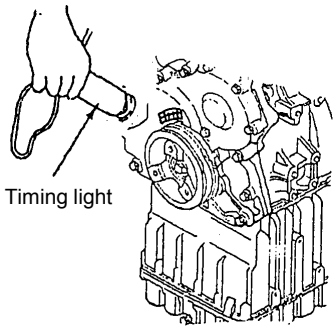
Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
E85 (75) display	Engine stall with the throttle open implies the insufficiency in engine output.		
	1) Insufficiency in engine output	[1] Fuel circuit malfunction (Inappropriate air-to-fuel ratio) └ Air cleaner clogging	- Check the air cleaner. - Check the gas-operated solenoid valve.
		[2] Ignition circuit malfunction ├ Ignition plug malfunction ├ Deposits or moisture ├ Plug gap out of specs. ├ High-tension cord malfunction └ Improper ignition timing	- See "(3) Checking the ignition plugs" in 3.3.3. - See "(4) Checking the high-tension cords" in 3.3.3. - See "(1) Checking and adjusting ignition timing".
		[3] Improper compression ├ Upward valve plunging └ Valve malfunction due to an obstruction	- See "(6) Checking for appropriate compression" in 3.3.3. - Clean the valve. See "(8) Improving incomplete compression due to an obstruction on the valve seat" in 3.3.3.
	2) Throttle control circuit faults	[1] Throttle malfunction ├ Stepping motor malfunction └ Improper output	- See "(2) Checking the throttle actuator".
	3) Noise or others	[1] Engine speed reading error or incomplete contact of the distributor connector	- See "(3) Checking the starter driving circuit for incomplete contact".
		[2] Incomplete contact of the 12 VDC terminal/connector connections	
		[3] Malfunction due to ignition circuit induced noise	- See "(4) Checking the ignition circuit for noise".

(1) Checking and adjusting ignition timing

[1] Connect the timing light pickup clip to the high-tension cord of one cylinder.

[2] Radiate timing light to the ignition advancer scale at the top of the rear crank pulley, and confirm ignition timing.

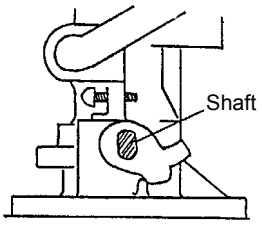
Engine Speed	Angle of Advance
1200 min^{-1}	16 ± 3°



Note:
The above is common to 13A and propane gases.

(2) Checking the throttle actuator

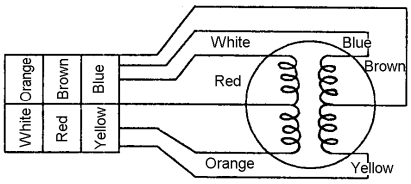
[1] When the OPERATE switch is turned on, the shaft of the throttle will temporarily operate to fully close the throttle valve and then open it to the specified angle, so as to initialize the stepping motor. Check if the initial operation of the shaft is normal.



[2] Measure conducting resistance between the connector terminals of the stepping motor.

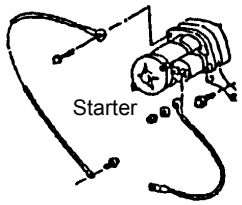
* Motor coil conducting resistance values

Measuring Point	Resistance Value
Between white and red Between red and orange Between blue and brown Between brown and yellow	140 Ω
Between white and orange Between blue and yellow	280 Ω



(3) Checking the starter driving circuit for incomplete contact

Incomplete contact of the starter driving terminals may cause engine stall due to noise.



Check the following sections, in particular:

1 Capacitor connection terminals
2 Diode connection terminals and body grounding connection terminals
3 Terminals for cord connection to the starter

(4) Checking the ignition circuit for noise

Insufficient insertion of the high-tension cord into the connector or internal disconnection of the cord itself may result in sudden engine stall due to noise and/or in malfunction due to an oil pressure or coolant temperature alarm whose cause cannot be readily identified.

[1] Check that the high-tension cord connectors are connected to the ignition plugs and the ignition coils properly.

[2] Measure the internal resistance between the high-tension cord terminals and check for abnormality such as disconnections.

High-tension cord No. 1	5.7 ± 2.2	kΩ (at 20°C)
High-tension cord No. 2	4.6 ± 1.8	
High-tension cord No. 3	3.5 ± 1.3	

3.4.5 Coolant Temperature Alarms

Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
E80 (80) display	Insufficient circulation of the coolant causes a significant temperature difference between the inlet and outlet of the radiator.		
	1) Insufficient circulation of the coolant	[1] Shortage, natural evaporation, or leakage of the coolant	- See "(1) Checking coolant circulation status". - See "(2) Checking the coolant level and for leakage".
		[2] Coolant pump failure ├ Pump malfunction └ No output	- See "(3) Checking the coolant pump".
		[3] Coolant pipeline clogging ├ Thermostat does not open └ Thermostat malfunction	- See "(4) Checking the thermostat".
	Although the temperature difference between the inlet and outlet of the radiator is normal, if the temperature of the entire radiator is too high, the heat release capability of the radiator is likely to be insufficient.		
	2) Insufficient heat release	[1] Radiator intake ├ Too high air temperature └ Short-circuiting	- See "(5) Checking coolant heat release status of the radiator during cooling".
		[2] Radiator fin clogging	- Clean the radiator fin.
		[3] Outdoor fan failure ├ Fan motor malfunction ├ No output └ Fan capacitor malfunction	- See "(6) Checking the outdoor fan motors".
E87 (70) display	3) Sensor or signal line faults	- Coolant temperature sensor detection error, malfunction, or incomplete contact or wire disconnections	- See "(7) Checking the coolant temperature sensor".
	4) Others	- Decrease in boiling temperature or malfunction in the radiator cap	- See "(8) Checking the radiator cap".

(1) Checking coolant circulation status

A decrease in the amount of coolant circulation due to pipeline clogging causes a significant temperature difference between the inlet and outlet of the radiator.
Confirm this temperature difference to judge whether the circulation of the coolant is normal.
During operation, also confirm the sensor-detected temperature (engine exit coolant temperature) in the monitoring data indicating mode of the maintenance board functions.

Approximate temperature difference (deg) between radiator inlet and outlet		Operating Conditions
Cooling	16 to 23	Rated
Heating	18 to 25	Rated

During operation of Model J/P280

(2) Checking the coolant level and for leakage

[1] Check the coolant level in the reservoir.

[2] Remove the radiator cap and check if the coolant level is at the upper limit mark.

⚠ CAUTION

- Be sure to use a genuine coolant (Aisin Coolant S, condensation 65%).

(3) Checking the coolant pump

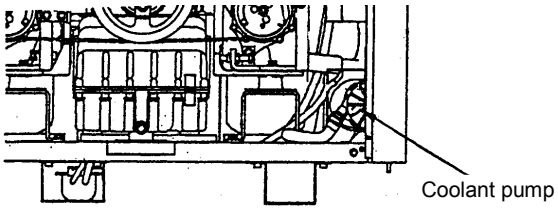
[1] Confirming coolant pump output

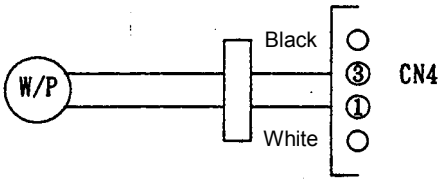
Check the maintenance board and the outdoor unit circuit board terminals and make sure that an output voltage of 200 VAC is supplied during operation.
If, in spite of the fact that the corresponding LED on the maintenance board is on, the required output voltage is not supplied, the switching circuit on the board is likely to be faulty.

[2] Checking the coolant pump body

Check for normal operating sounds.
If the pump does not operate, confirm the resistance values of the motor coils.

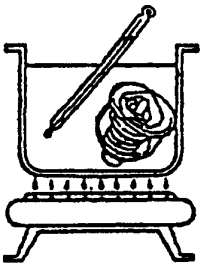
Motor coil reference resistance value = 58.4 Ω ± 10%

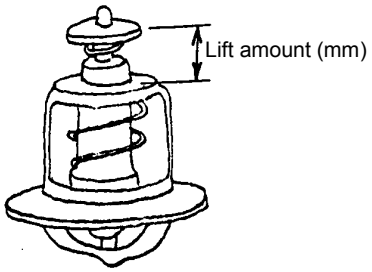




(4) Checking the thermostat

If, despite the coolant pump being normal, the circulation rate of the coolant is not normal, the thermostat may not have opened properly. Check the operation of the thermostat.





Thermostat changeover temperature

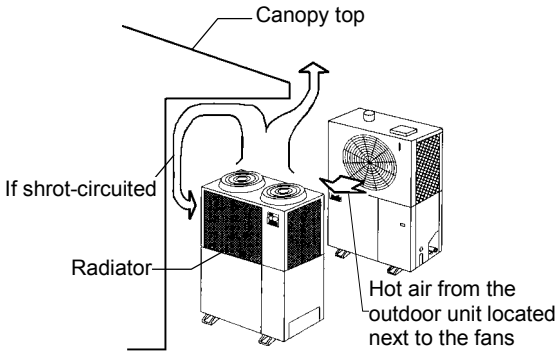
Opening start: 62°C	Lifting amount: 12 mm
Full-opening: 72°C	Lifting amount: 18.5 mm

(5) Checking coolant heat release status of the radiator during cooling

Although the temperature difference between the inlet and outlet of the radiator is normal, if the temperature of the entire radiator is too high, perform the following checks:

[1] Check for significant increases in the ambient temperature of the radiator due to short-circuiting or other unusual events.

[2] Check the radiator fins for clogging and dirt.



(6) Checking the outdoor fan motors

If the outdoor fans are not functioning properly, check them as directed below.

Note:
The number of fans to be operated is controlled during low-temperature cooling and high-temperature heating.

[1] Check that an output voltage of 200 VAC is properly developed at the output of the CN13 connector on the outdoor unit circuit board.

[2] Measure the fan motor coil resistances at the connector terminals (relay connector).

Coil resistance values between fan motor terminals

[22.4 kW, 28.0 kW]

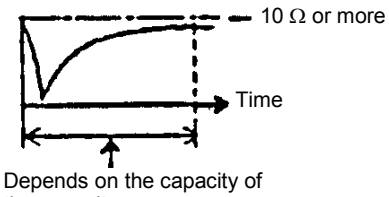
FM1	White - Black	24.6 ± 10%	Ω
	Black - Yellow	60.9 ± 10%	
FM2	White - Black	24.6 ± 10%	
	Orange - Red	35.2 ± 10%	
	Red - Black	25.7± 10%	

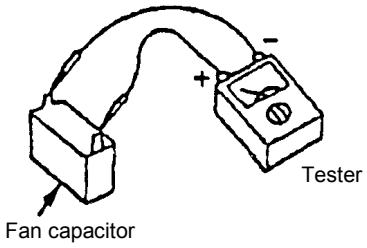
[35.5 kW]

FM1	White - Black	17.4 ± 10%	Ω
	Black - Yellow	17.3 ± 10%	
FM2	White - Black	17.4 ± 10%	
	Orange - Red	6.4 ± 10%	
	Red - Black	11.0± 10%	

Note:
If the coil resistances are infinite, thermal fuses are likely to be functioning.

[3] Checking the fan capacitor
Connect an insulation voltage tester across the fan capacitor within the outdoor unit control box and check the transient characteristics of the resistance value.





(7) Checking the coolant temperature sensor

Check the connector for backlash and improper electrical contact.
Also, measure the resistance values between the coolant temperature sensor terminal and body and the coolant temperature (bypass pipe surface temperature) and examine for significant deviations from reference characteristics.

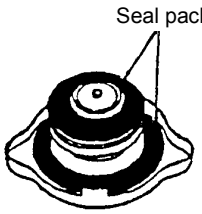
Characteristics of the coolant temperature sensor

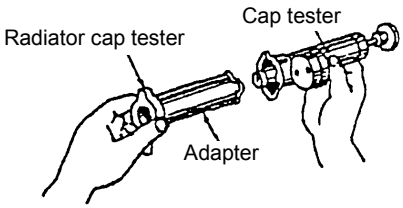
Temperature	Resistance
50°C	17.6 kΩ
80°C	6.1 kΩ
100°C	3.3 kΩ
110°C	2.5 kΩ

(8) Checking the radiator cap

[1] Make sure that the seal packing is free from cracking, deformation, and other defects.

[2] Make sure that the operating pressure at the radiator cap is within 0.05 ± 0.01 MPa.





3.4.6 Oil Pressure Alarms

Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
E81 (81) display Oil pressure alarm	1) Decrease in oil pressure	If the oil pressure decreases during operation [1] Shortage of oil ├ Oil leakage └ Unusual oil consumption [2] Oil line clogging └ Oil strainer clogging	- See "(1) Checking oil consumption". - See "(2) Checking the oil pressure".
	2) Sensor signal circuit faults	[1] Oil pressure switch malfunction ├ Sensor fault └ Improper contact	- See "(3) Checking the oil pressure switch".
	3) Noise, others	[1] Ignition system └ Improper contact [2] Starter driving system └ Improper contact	- See "(4) Checking the ignition circuit for noise" in 3.3.4. - See "(4) Checking the starter driving circuit for improper electrical contact".

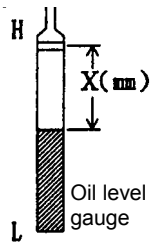
(1) Checking oil consumption

Estimate engine oil consumption from the decrement in oil level and the previous maintenance result data.

$$\text{Consumption } (\text{cm}^3/\text{h}) = \frac{\text{A change in oil level (mm)} \times 132}{\text{Hours of operation (h)}}$$

Standard value: 1.0 to 3.0 cm^3/h

Excessive consumption causes carbon to accumulate at the electrodes of the ignition plugs, resulting in an engine starting failure due to incomplete ignition. In such a case, driving valve parts (stem seals) and piston rings are likely to be malfunctioning.



(2) Checking the oil pressure

If the oil strainer clogs and the oil is not supplied properly, the required oil pressure will not be obtained. Apply a pressure gauge to the mounting hole (PT1/4) of the oil pressure switch and measure the oil pressure. Also, check the oil level using the oil level gauge. Add 2 to 3 liters of oil if the oil level is too low (near the "L" level mark).

Standard value: 0.147 to 0.490 MPa at 1800 min^{-1}

(3) Checking the oil pressure switch

Checking during shutdown

[1] Check the oil pressure switch terminals for improper electrical contact due to backlash.

[2] Check for normal operation of the oil pressure switch by examining for electrical continuity between the terminals.

Engine Status	Oil Pressure Switch Terminal
Stop	Continuity
Operation	No continuity

(4) Checking the starter driving circuit for improper electrical contact

Improper electrical contact between the starter driving terminals may cause an oil pressure alarm due to induced noise.

Check the following sections, in particular:
1 Capacitor connections
2 Diode connection terminals and body grounding connection terminals
3 Terminals for cord connection to the starter and others

3.4.7 Engine Speed Too High Alarm

Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
E82 (82) display	Throttle returning failures	[1] Throttle lever malfunction └ Mixer throttle failure [2] Stepping motor malfunction └ Trouble with the stepping motor itself	- Check the operation of the throttle.

3.4.8 High-Pressure Alarms During Cooling

Trouble		Classification of Likely Causes	Sub-Classification	Check and Remedy
E40 (76, 86) Refrigerant high-pressure alarm	During cooling	1) Heat exchange inside the condenser of the out-door unit is obstructed.	[1] Outdoor fan failure ├ Presence of an obstruction (Interference) ├ No output ├ Fan motor malfunction └ Fan capacitor fault	- See "(1) Checking the refrigerant high-pressure level". - See "(6) Checking outdoor fan motors" in 3.3.5.
			[2] Deteriorated heat exchange capability └ Heat exchanger fin clogging or interference	- Clean the heat exchanger fins.
			[3] Too high intake air temperature ├ Severe environmental conditions or installation status └ Short-circuiting or others	- See "(2) Confirming the operating environmental conditions".
		2) Refrigerant circuit faults	[1] Inappropriate amount of refrigerant └ Overfilling	- See "(3) Checking the check valve angle".
			[2] Refrigerant flow channel clogging ├ Check valve sticking ├ Pipeline clogging or breakage └ Ball valve malfunction (or not fully open)	- Repair the faulty section. - Check if the ball valve is fully open.
			[3] Entry of uncondensed gas into the refrigerant circuit	
			[4] Indoor unit electronic expansion valve malfunction	- See "(6) Checking the electronic expansion valves".
			[5] Liquid flow regulating valve malfunction	- See "(4) Checking the liquid flow regulating valve in 3.3.11.
		3) Sensor or signal line faults	[1] Refrigerant high-pressure switch malfunction └ Refrigerant high-pressure switch circuit fault, improper contact, or wire disconnections	- See "(4) Checking the refrigerant high-pressure switch".
			[2] High-pressure switch malfunction └ High-pressure switch circuit fault, improper contact, or wire disconnections	- See "(5) Checking the refrigerant high-pressure sensor".
		4) Engine circuit faults	[1] Throttle returning failure └ Throttle lever malfunction or stepping motor malfunction	- Check the throttle operation.

(1) Checking the refrigerant high-pressure level

Measure refrigerant pressure levels from the high-pressure detection ports on the right side of the engine room. If measured data oversteps the ranges listed below, the heat exchange section of the condenser or the refrigerant circuit is malfunctioning.

Operating refrigerant pressure values for reference only (during operation of Model P280)

Mode	Low Pressure	High Pressure	Outside Air Temp.	Room Temp.
Cooling	0.35 to 0.66 MPa	1.67 to 2.45 MPa	20 to 40°C	27°C
Heating	0.36 to 0.81 MPa	2.11 to 2.40 MPa	0 to 15°C	21°C

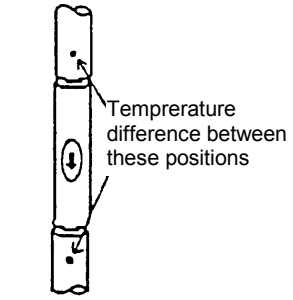
(2) Confirming the operating environmental conditions

Check for unusual increases in the intake air temperature of the outdoor air heat exchanger due to short-circuiting or other effects of external or peripheral system components.

Maximum Permissible Operating Temperature	
Intake air temperature of the outdoor air heat exchanger	43°C

(3) Checking the check valve angle

Clogged check valve in the refrigerant room causes the flow of the refrigerant to stop inside the condenser, thus leading to increases in refrigerant pressure due to the shortage of the heat release area.
Measure the pipeline temperatures in front of and at the rear of the check valve, and if there is a significant temperature difference of 5 deg or more, replace the check valve since it is clogged.

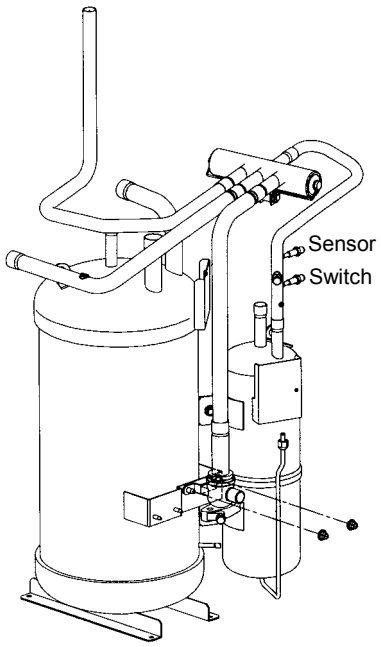


Check valve

(4) Checking the refrigerant high-pressure switch

[1] Checking the refrigerant high-pressure switch for continuity
Check for continuity between connector terminals under a stopped status. If continuity is not detected or if it is interrupted by applying shocks to the switch body, replace the switch since its contact points are malfunctioning.

[2] Checking the refrigerant high-pressure switch for normal operation
While performing continuity checks from the connector terminals and based on the pressure data from the high-pressure detection ports, measure the pressure applied when the switch operates (continuity is lost). The switch is normal if it turns off at 2.8 MPa.



(5) Checking the refrigerant high-pressure sensor

[1] Comparing pressures under a stopped status
Confirm on the maintenance board the pressure detected by the high-pressure sensor, and compare this value with the pressure indicated by a high-pressure gauge.

High-pressure level: Code No. 60 on maintenance board

Use a properly calibrated gauge to perform measurements, and zero-adjust the gauge before starting the measurements.

a) The sensor is normal if the difference in pressure is within ±0.1 MPa.
b) If the pressure displayed on the maintenance board is between 0.0 and 0.1 MPa (in spite of the gauged pressure being higher), check for connector disconnections and proceed to step [3] below.
c) If the pressure displayed on the maintenance board is 2.9 MPa or more, skip to step [5] below.
d) In cases other than b) and c) above, check pressure with the system in operation and then proceed to step [2] below.

[2] Comparing pressures under the operational status
- The sensor is normal if the difference in pressure is within ±0.15 MPa.
- Proceed to step [3] below if the difference is not within ±0.15 MPa

Stop the outdoor unit and perform the following checks:

[3] Checking the outdoor unit circuit board for improper connector contact
Disconnect and reconnect CN7 from the outdoor unit circuit board, and check if the pressure displayed on the maintenance board returns to normal. Perform repairs if improper contact is detected. If the pressure does not return to normal, proceed to step [4] below.

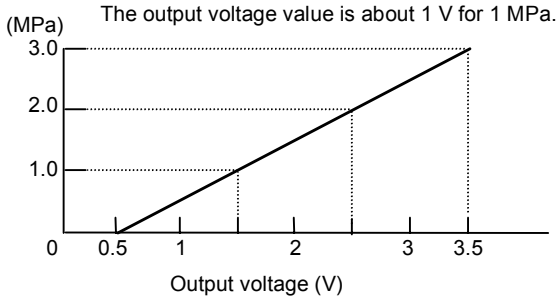
[4] Confirming the pressure sensor supply voltage
Confirm whether the supply voltage to the pressure sensor is within 5 ± 0.5 V (measure the voltage between pins 8 and 4 on connector CN7).

- If the voltage is within 5 ± 0.5 V, proceed to step [5] below.
- In other cases, replace the outdoor unit circuit board since it is faulty.

[5] Confirming the pressure sensor output voltage
Measure the voltage developed across the output of the pressure sensor (namely, between pins 3 and 4 on connector CN7).

Required pressure (MPa) = (Output voltage – 0.5)

Compare the measured value and the pressure indicated by a high-pressure gauge.
- If the difference is within ±0.1 MPa, the pressure sensor is normal. In this case, replace the outdoor unit circuit board since it is faulty.
- If ±0.1 MPa is overstepped, replace the pressure sensor since it is malfunctioning.



(6) Checking the electronic expansion valves (for indoor unit)

[1] Checking if the electronic expansion valves open
After about 30 minutes of cooling, the electronic expansion valves in indoor units about 10°C higher than the respective heat exchanger temperatures may not open, even during the operation of all indoor units.
(Even when an indoor unit has its electronic expansion valve operating properly, the heat exchanger temperature differs by about 5 to 7°C, depending on the type and capacity of indoor unit and on the indoor temperature.)

- Proceed to step [2] below if the electronic expansion valves are not open.

[2] Confirming the output voltages of the indoor unit circuit board

- Measure the voltages developed at the control pins of electronic expansion valve connector CnA (white, 6-pin, 5-conductor). Also, measure how long the voltages are applied.

  a) Between orange and gray
  b) Between red and gray
  c) Between yellow and gray
  d) Between black and gray*

  For a) to d) above, after power-on, a voltage of approx. 5 VDC is applied for about 15 sec. (After power-on, a voltage of 5 VDC must be developed for about 8 sec and then after the voltage has temporarily decreased, it must increase to about 5 VDC for about another 8 sec.)

  *: During measurement using a digital multimeter, voltages from about 3 to 6 VDC must be developed in sequence.

- If the above is confirmed, the indoor unit circuit board is normal.
- If the electronic expansion valve does not operate (does not generate operating sounds) under a voltage-applied status, proceed to step [3] below.
- In the other cases proceed to step [4] below.

[3] Checking the electronic expansion valve

- Measure with a tester the resistance value between pin connections (see a) to d) below) of the connector at the electronic expansion valve, and if the measured value is 0 ohms or an infinity, replace the coil. The normal value is about 40 ohms.

  a) Between orange and gray
  b) Between red and gray
  c) Between yellow and gray
  d) Between black and gray

[4] Confirming the opening of the electronic expansion valve

- Operate the indoor unit and check for passing sounds of the refrigerant inside the refrigerant pipeline during the operation of the unit. If no passing sounds are heard, the electronic expansion valve is malfunctioning.
  (However, check the heat exchanger temperature and make sure that the heat exchanger is not in a stopped status for the purpose of antifreezing. Verify that temperature control is not stopped, either.)

3.4.9 High-Pressure Alarms During Heating

Trouble		Classification of Likely Causes	Sub-Classification	Check and Remedy
E40 (76, 86) Refrigerant high-pressure alarm	During heating	1) Heat exchange inside the condenser of the in-door unit is obstructed.	[1] Indoor fan failure - Presence of an obstruction (Interference) - No output - Fan motor malfunction - Fan capacitor fault [2] Deteriorated heat exchange capability (Obstructed ventilation) - Air filter clogging - Heat exchanger fin clogging [3] Too high intake air temperature - Severe environmental conditions - Short-circuiting or others	- See “(1) Checking the refrigerant high-pressure level” in 3.3.8. - Check the indoor fan motor. See (2). - Clean the air filter. - Clean the heat exchanger fins.
		2) Refrigerant circuit faults	[1] Inappropriate amount of refrigerant - Overfilling [2] Refrigerant flow channel clogging - Ball valve closed - Pipeline clogged, or damaged - Check valve clogged [3] Entry of uncondensed gas into the refrigerant circuit - Ingress of air [4] Indoor unit electronic expansion valve malfunction (opening failure) [5] Hot-gas bypass valve malfunction - Malfunction (opening failure) - Sticking [6] Capacity regulating valve malfunction	- Check if the ball valve is fully open. - Repair the faulty section. - See “(3) Checking the check valve angle” in 3.3.8. - See “(6) Checking the electronic expansion valves” in 3.3.8. - See “(1) Checking hot-gas bypass valve during heating”. - See “(4) Checking the liquid flow regulating valve and capacity regulating valve” in 3.3.11.
		3) Sensor or signal line faults	[1] Refrigerant high-pressure switch malfunction - Refrigerant high-pressure switch circuit fault, improper contact, or wire disconnections [2] High-pressure sensor malfunction - High-pressure sensor circuit fault, improper contact, or wire disconnections	- See “(4) Checking the refrigerant high-pressure switch” in 3.3.8. - See “(5) Checking the refrigerant high-pressure sensor” in 3.3.8.
		4) Engine circuit faults	[1] Throttle returning failure - Throttle lever malfunction or stepping motor malfunction	- Check the throttle operation. See 3.3.7.

(1) Checking hot-gas bypass valve during heating

[1] Measure the coil resistance between pins 1 and 8 of connector CN14 on the outdoor unit circuit board.

Reference resistance value = 800 Ω

[2] After confirming on the maintenance board that the hot-gas bypass valve is open, make sure that the required voltage is applied between pins 1 and 8 of connector CN14 on the outdoor unit circuit board. (Required voltage: 200 VAC)
If the required output voltage is not obtained, the board is likely to be faulty.

[3] Measure the pipeline temperature at the downstream side of the solenoid valve when seen from the hot-gas bypass valve.

- If the hot-gas bypass valve is normal, a temperature slightly lower than the discharge temperature will be obtained.
- If the bypass valve is stuck, temperature will not increase when the valve opens.

Replace the hot-gas bypass valve if stuck.

(2) Fan motor coil resistance

See Chapter 6, MAINTENANCE DATA STANDARDS.

3.4.10 Refrigerant Low-Pressure Alarms

Trouble		Classification of Likely Causes	Sub-Classification	Check and Remedy
E57 (88) display Refrigerant low-pressure alarm	During cooling	1) Heat exchange inside the evaporator of the indoor unit is obstructed.	[1] Indoor fan failure - Presence of an obstruction (Interference) - No output - Fan motor malfunction - Fan capacitor fault	- Check the indoor fan motor. See (2) in 3.3.9.
			[2] Deteriorated heat exchange capability (Obstructed ventilation) - Air filter clogging - Heat exchanger fin clogging	- Clean the air filter. - Clean the heat exchanger fins.
			[3] Too low intake air temperature - Short-circuiting or others	
	During heating	2) Heat exchange inside the evaporator of the out-door unit is obstructed.	[1] Outdoor fan failure - Presence of an obstruction (Interference) - No output - Fan motor malfunction - Fan capacitor fault	- See “(6) Checking the outdoor fan motors” in 3.3.5
			[2] Deteriorated heat exchange capability - Heat exchanger fin clogging or interference	- Clean the heat exchanger fins.
			[3] Too low intake air temperature - Outside air temperature below –10°C	- Confirm the operating conditions.
			[4] Deteriorated double-pipe heat exchanger capabilities - Engine coolant channel clogging, - Thermo valve malfunction - Thermo valve mis-mounting	
	During cooling and heating	3) Inappropriate amount of refrigerant	Shortage of the refrigerant - Refilling not enough - Refrigerant leakage	- See “(1) Checking the amount of refrigerant”.
		4) Refrigerant circuit faults	Refrigerant circuit clogging - Ball valve closed - Dryer filter clogged	- See “(2) Checking the dryer filter for clogging”.
			- Indoor unit electronic expansion valve	- See “(3) Checking the indoor electronic expansion valve for clogging”.
			- Capacity regulating valve clogged	- See “(4) Checking the liquid flow regulating valve and capacity regulating valve” in 3.3.11.
			- Check valve clogged - Liquid flow regulating valve clogged	- See “(4) Checking the check valve for clogging”.
		5) Low-pressure switch faults	Refrigerant low-pressure switch malfunction - Trouble with the switch itself - Incomplete contact or wire disconnections	- See “(5) Checking the refrigerant low-pressure switch”.
	During cooling	6) Hot gas bypass valve faults	Hot-gas bypass valve malfunction - Defects in operation - Clogging	- See “(1) Checking the hot-gas bypass valves during heating” in 3.3.9.

(1) Checking the amount of refrigerant

Operate all indoor units and measure refrigerant pressure levels from the high-pressure detection ports provided inside the engine room.
If measured data oversteps the ranges listed below, the heat exchange section of the condenser or the refrigerant circuit is malfunctioning.

Operating refrigerant pressure values for reference only (during operation of Model P280)

Mode	Low Pressure	High Pressure	Outside Air Temp.	Room Temp.
Cooling	0.35 to 0.66 MPa	1.67 to 2.26 MPa	20 to 40°C	27°C
Heating	0.36 to 0.81 MPa	2.11 to 2.26 MPa	0 to 15°C	21°C

(2) Checking the dryer filter for clogging

Fully or partially clogged dryer filter in front of the expansion valve reduces the refrigerant pressure. Measure the pipeline temperatures in front of and at the rear of the dryer filter, and if measured values significantly differ by 5°C or more, replace the filter since it is clogged.

(3) Checking the indoor electronic expansion valve for clogging

[1] Turn off the power circuit breaker temporarily and then turn it back on. The indoor electronic expansion valve will repeat full-opening and full-closing actions. Confirm the operating sounds at this time.

[2] Disconnect the CnA connector from the indoor unit circuit board and measure coil resistance values between the pin terminals of the driving motor.

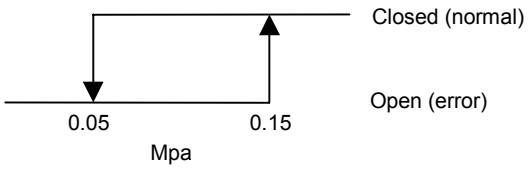
Pin Connection To Be Measured	Reference Resistance Value (±10%)	
Orange - Red	90	Ω
Red - Yellow	90	
Yellow - Black	90	
Black - Gray	45	
Gray - Orange	45	

(4) Checking the check valve for clogging

Clogged check valve reduces the refrigerant pressure. Measure the pipeline temperatures in front of and at the rear of the check valve, and if measured values significantly differ by 5°C or more, replace the valve since it is clogged.

(5) Checking the refrigerant low-pressure switch

Confirm electrical continuity between pins 1 and 2 of connector CN8 on the outdoor unit circuit board.
If no continuity is detected or if applying a shock to the switch body interrupts continuity, the contacts of the switch are not normal; replace it in that case.



3.4.11 Refrigerant Discharge Temperature Alarms

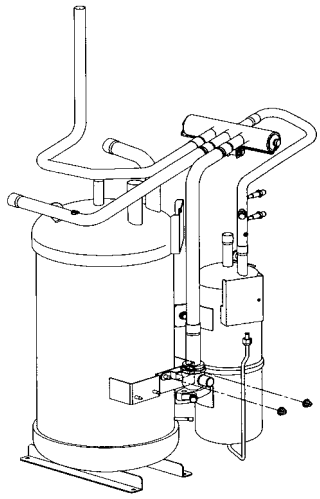
Trouble		Classification of Likely Causes	Sub-Classification	Check and Remedy
E36 (91) display Discharge tempera-ture alarm	Too high compressor discharge temperature	1) Too high compressor intake temperature	The discharge temperature increases with increases in compressor intake temperature (superheating level). [1] Too high superheating level (Refrigerant undercirculation) - Shortage of refrigerant - Leakage or mere shortage - Refrigerant channel blocking - Indoor unit electronic expansion valve malfunction - Dryer filter clogging - Check valve clogging [2] Hot-gas leakage to intake port - Leaks in four-way changeover valve - Valve malfunction [3] Injection error - Injection shortage - Liquid injection valve malfunction - Liquid injection pipe clogging	- Check the operational status. - See “(1) Checking the amount of refrigerant” in 3.3.10. - Check the indoor unit electronic expansion valve. See (3) in 3.3.10. - See “(2) Checking the dryer filter for clogging” in 3.3.10. - See “(4) Checking the check valve for clogging” in 3.3.10. - See “(1) Checking the four-way changeover valve”. - See “(4) Checking the liquid flow regulating valve and the capacity regulating valve”.
		2) Too high condensing pressure	The discharge temperature increases with increases in condensing pressure. [1] Insufficient heat release - Indoor air filter clogging during heating - Indoor heat exchanger fin clogging during heating - Outdoor heat exchanger fin clogging during cooling [2] Intake air - Inappropriate environmental conditions or short-circuiting during cooling [3] To refrigerant supply line	- Clean the indoor air filter. - Clean the indoor heat exchanger fins. - Clean the outdoor heat exchanger fins. - See “(2) Confirming the operating environmental conditions” in 3.3.8. - Confirm the operational status of the compressor.
		3) Deteriorated compression efficiency Overheating of the compressor body	If, in spite of the compressor rotating at full speed, adequate air conditioning cannot be obtained at low condensing pressure and high evaporation pressure, the compressor is likely to have deteriorated in compression efficiency. Insufficient compression efficiency - Compressor malfunction	- Confirm the operational status of the compressor.
		4) Hot-gas bypass valve malfunction	Hot-gas bypass valve malfunction - Malfunction (open) - Interference due to obstructions	- See “(2) Checking the hot-gas bypass valves”.
		5) Discharge temperature sensor malfunction	Discharge temperature sensor - Trouble with the sensor itself	- See “(3) Checking the discharge temperature sensor”.

(1) Checking the four-way changeover valve

Four-way changeover valve malfunction may cause the slide valve to get stuck in its middle position, and if this state persists, the hot gas will leak into the intake port and increase the intake temperature, with the result that the discharge temperature will also increase.

[1] Check for unusual operating sounds (clear hissing sounds) from the four-way changeover valve during operation.

[2] Check for significant temperature differences between the inlet and outlet of the four-way changeover valve for the low-pressure refrigerant gas.



(2) Checking the hot-gas bypass valves

[1] Measure coil resistance between pins 1 and 8 of the CN14 connector on the outdoor unit circuit board.

Reference resistance value = 800 Ω

[2] After confirming on the maintenance board that the hot-gas bypass valves are closed, measure the voltage between pins 1 and 8 of the CN14 connector on the outdoor unit circuit board.
If 200 VAC is constantly supplied, the board may be faulty.

[3] Measure the pipeline temperatures at the downstream side of the solenoid valves with respect to the hot-gas bypass valves.
When the bypass valves are open, temperatures slightly lower than the discharge temperature must be detected.
Obstructions may be interfering with the hot-gas bypass valves if the valves are open without 200 VAC being applied.

(3) Checking the discharge temperature sensor

Confirm the sensor-detected operating discharge temperature using the data display function of the maintenance board, and measure an actual temperature. Judge from these temperatures whether the sensor is normal.

Characteristics of the discharge temperature sensor

Standard Temperature		Resistance Value	
0	°C	182.9	kΩ
20		70.4	
50		20.2	
80		7.0	
100		3.7	
120		2.1	

(4) Checking the liquid flow regulating valve and the capacity regulating valve

[1] Checking the mechanical lock of the liquid flow regulating valve (electronic expansion valve)

The motor, when driven with the mechanical section of the liquid flow regulating valve locked, runs idle and generates weak “click” sounds.
When the lock is normal, these sounds are heard under the fully closed status of the valve during power-on and no such sounds are heard under the open status of the valve.
The lock is abnormal if such sounds are heard under both the fully closed status and open status of the valve. Replace the liquid flow regulating valve in that case.

[2] Confirming motor coil resistance values

Measure resistances between motor coils (red - white, red - orange, brown - yellow, and brown - blue), and make sure that measured values are as listed below.

Reference resistance value = 150Ω ± 10%

[3] Confirming the continuity of the connectors and wiring

After checking for connector disconnections, disconnect the connectors and confirm the continuity of the wiring.

3.4.12 Communications Trouble and Indoor Unit Circuit Trouble

Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
Communications trouble display E2 (2) display E3 (3, 4) display E4 (–) display E10 (–) display E14 (14) display E31 (31) display	1) Indoor and outdoor unit address number errors	If an unusable address is assigned - Indoor unit address number overlapping - Outdoor unit address number assignment error - Indoor unit address number assignment error - Too many indoor units connected - Sub-unit address number assignment error - Outdoor unit address number overlapping	- Check the assigned address number. See the item on function select DIP switches.
E6 (96) display E7 (97) display	2) Indoor unit sensor short-circuiting or wire disconnections	[1] Heat exchange sensor Sensor malfunction Incomplete contact or wire disconnections [2] Intake sensor Sensor malfunction Incomplete contact or wire disconnections	- See “(1) Checking the temperature sensor”.
E8 (8) display	3) Heating overload alarm	[1] Heating overload [2] Indoor unit heat exchanger thermistor malfunction [3] Indoor unit circuit board fault (Thermistor input circuit fault)	- See “(2) Confirming indoor unit intake status”. - See “(1) Checking the temperature sensor”.
E9 (95) display	4) Drain water float switch on	[1] Drain water accumulation Drain piping defects Riser or sloped Drain pump failure No output Incomplete contact or disconnections Pump malfunction [2] Float switch malfunction	- See “(3) Testing for normal drainage”. - See “(4) Checking the drain pump”. - See “(5) Checking the float switch”.

(1) Checking the temperature sensor

Confirm the sensor-detected temperature using the data indication function of the maintenance board, and measure an actual temperature. Judge from these temperatures whether the sensor is normal.

Judgment criteria for temperature sensor

Temperature (°C)	Standard Resistance (kΩ)
-10	29.1
0	16.8
10	10.0
20	6.2
30	4.0
40	2.6
50	1.8

(2) Confirming indoor unit intake status

Make sure that the intake port of the indoor unit is free from blocking, that the filter is not clogged, and that the fan motors operate properly.

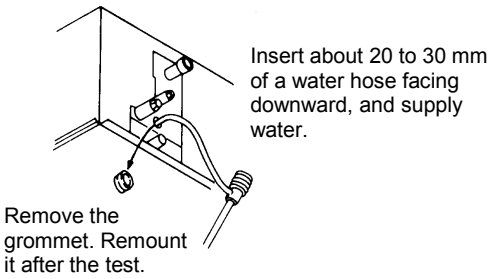
(3) Testing for normal drainage

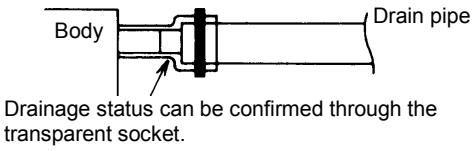
[1] Slowly supply about 1 liter of water seeing the left view below:

[2] Connect the remote control switch and start the system in cooling mode.

When the compressor is turned on, the drain pump will start rotating.

[3] Test for normal drainage while confirming the rotating sounds of the drain pump.





The water may not be drained from the drain pipe even though the drain pump is in operation, or the possible backflow of the water, associated with the stop of the pump, may result in an error. The situation under which these events may occur is shown below.

(4) Checking the drain pump

[1] Confirming the operating sounds of the pump

Confirm the operation of the pump by judging from its operating sounds and from the flow of the water through the pipe.

[2] Confirming the output voltage

If the drain pump is not functioning, check for an output voltage of 200 VAC at the output terminals of the indoor unit circuit board.

[3] Checking the drain pump motor

Measure coil resistances between lead-wired terminals, and scan for disconnections and short-circuiting.

Type of Indoor Unit	Reference Resistance Values
TKTP (4-way cassette type)	212 Ω
TKTWP (2-way cassette type)	
TKRP (Built-in cassette type)	136 Ω
TKTSP (1-way cassette type)	
TKUMP (Medium static-pressure duct type)	327 Ω

(5) Checking the float switch

Confirm the electrical conducting status of the float switch (FS).

Normal	Conducting
Abnormal	Not conducting

Note:
Error code E9 will be displayed if the switch wiring is disconnected or if the switch itself is not connected.

3.4. 13. If Sufficient Cooling Cannot Be Obtained

Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
Insufficient cooling	1) Electromagnetic clutch of the compressor is not engaged.	[1] Electromagnetic clutch malfunction ├── Trouble with the clutch itself ├── Incomplete contact └── No output ── Control section	- See "(1) Checking the electromagnetic clutch".
		[2] Indoor temperature sensor malfunction ├── Incomplete contact or wire disconnections └── Sensor fault (Adequate air conditioning cannot be obtained since the indoor temperature is mis-judged to be lower than its actual value.)	- See "(1) Checking the temperature sensor" in 3.3.12.
		[3] Heat exchanger temperature sensor ├── Incomplete contact or wire disconnections └── Sensor fault (Since the heat exchanger temperature is mis-judged to be lower than its actual value, the antifreezing control function operates during cooling.)	- See "(1) Checking the temperature sensor" in 3.3.12.
	2) Electromagnetic clutch of the compressor is engaged.	[1] Automatic activation of refrigerant circuit protector	- Confirm circuit protector status.
		No error is displayed until the refrigerant circuit protector has repeated its automatic activation and automatic resetting several times. During this automatic resetting cycle, therefore, the clutch is repeatedly engaged and disengaged.	
		[2] Extreme decrease in indoor heat exchanger temperature ├── Expansion valve clogging ├── Dryer filter clogging └── Other clogged/blocked status (The antifreezing control function of the indoor heat exchanger operates.)	- See "(3) Checking the indoor electronic expansion valve for clogging" in 3.3.10. - See "(2) Checking the dryer filter for clogging" in 3.3.10.
	3) Improper indoor unit heat exchange	[1] Insufficient ventilation ├── Indoor unit air filter clogging └── Heat exchange fin clogging	- Clean the indoor unit air filter.
		[2] Improper indoor fan motor rotation ├── Abnormal output voltage ├── Fan capacitor malfunction └── Fan motor malfunction	- Check the indoor fan motor. See 3.3.9.

Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
	4) Compressor rotates, but cold air is not supplied.	[1] Shortage of refrigerant └ Underfilling └ Refrigerant leakage [2] Refrigerant circuit fault └ Four-way changeover valve body malfunction └ Others [3] Indoor unit electronic expansion valve malfunction [4] Hot-gas bypass valve does not close	- Check the operational status. - See "(1) Checking the amount of refrigerant" in 3.3.10. - See "(2) Checking the four-way changeover valve". - See "(6) Checking the electronic expansion valves" in 3.3.8. - Check the hot-gas bypass valve.
Insufficient cooling	5) Engine speed does not increase (during a mode such as error avoidance control).	[1] High-pressure error avoidance [2] Discharge temperature error avoidance [3] Coolant temperature error avoidance [4] Insufficiency in engine output └ Engine starts, but it stalls.	- See high-pressure error check items. - See discharge temperature error check items. - See coolant temperature error check items. - See engine stall check items.
	6) Installation status is not appropriate.	[1] Significant loss of pressure in the piping └ Piping between indoor and outdoor units is too long. └ Too many bends are present. └ Branched piping is too long. └ Piping size is not appropriate. [2] Significant difference in elevation [3] Piping branches └ The branch pipe is not mounted at the correct angle. └ The branched header is further branched. [4] The total connection capacity of the indoor units is too large.	- Actual length: 100 m (max.) - Equivalent length: 125 m (max.) - Length from the first branch: 40 m (max.) - Between indoor and outdoor units (max.) Outdoor unit upper: 50 m Outdoor unit lower: 40 m - Difference in elevation between indoor units: 15 m (max.) - Approx. 130% or less (Capability decreases in proportion to the excess amount of capacity.)

(1) Checking the electromagnetic clutch

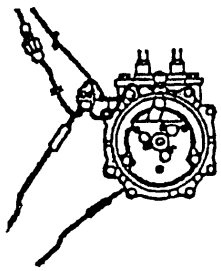
[1] Confirming output voltage

Measure the output voltage (12 VDC) between outdoor unit circuit board output terminals (CON11 pin 2 and frame ground).
If, in spite of the fact that the corresponding LED on the maintenance board is on, the required output voltage is not supplied, the switching circuit on the board is likely to be faulty.

[2] Checking the electromagnetic clutch

Measure the conducting resistance between the connector and frame ground terminal of the electromagnetic clutch, and check for coil disconnections.

Note:
Disconnect the connector before measuring the conducting resistance.



(2) Checking the four-way changeover valve

If the four-way changeover valve does not shift from heating mode, hot air will be supplied, even during operating in cooling mode.
Such a state implies that the output voltage remains applied to the electromagnetic coil or that the valve inside the main unit is malfunctioning.

3.4.14 If Sufficient Heating Cannot Be Obtained

Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
Insufficient heating	1) Electromagnetic clutch of the compressor is not engaged.	[1] Electromagnetic clutch malfunction - Trouble with the clutch itself - Incomplete contact - No output — Control section [2] Indoor temperature sensor malfunction - Short-circuiting - Sensor fault (Adequate air conditioning cannot be obtained since the indoor temperature is mis-judged to be higher than its actual value.)	- See "(1) Checking the electromagnetic clutch" in 3.3.13. - See "(1) Checking the temperature sensor" in 3.3.12.
	2) Electromagnetic clutch is disengaged immediately after being engaged.	[1] Automatic activation of refrigerant circuit protector No error is displayed until the refrigerant circuit protector has repeated its automatic activation and automatic resetting several times. During this automatic resetting cycle, therefore, the clutch is repeatedly engaged and disengaged.	- Confirm circuit protector status.
	3) Improper indoor unit heat exchange	[1] Insufficient ventilation - Indoor unit air filter clogging - Heat exchange fin clogging [2] Improper indoor fan motor rotation - Abnormal output voltage - Fan capacitor malfunction - Fan motor malfunction	- Clean the indoor unit air filter. - Check the indoor fan motor. See 3.3.9.
	4) Sufficient compressor capabilities cannot be obtained.	First, measure the refrigerant pressure and temperature during operation and check the refrigerant cycle. [1] Insufficient heat exchange in evaporator - Hot-water heat collection failure - Continued flow of coolant into radiator - Thermostat malfunction - Coolant circuit clogging - Failure to collect heat from hot air supply - Insufficient ventilation - Outdoor fan failure - Fin clogging - Short-circuiting - Too low intake air temperature [2] Insufficient circulation of refrigerant - Shortage of refrigerant - Underfilling - Refrigerant leakage - Refrigerant channel clogging - Expansion valve sticking - Dryer filter clogging [3] Indoor unit electronic expansion valve malfunction [4] Hot-gas bypass valve does not close	- Check the operational status. - Check the thermo valve. See (4) in 3.3.5 and (1) in 3.3.12. - See "(6) Checking outdoor fan motors" in 3.3.5. - Clean the heat exchanger fins. - See "(1) Checking the amount of refrigerant" in 3.3.10. - See "(3) Checking the indoor electronic expansion valve for clogging" in 3.3.10. - See "(2) Checking the dryer filter for clogging" in 3.3.10.motor. - See "(6) Checking the electronic expansion valves" in 3.3.8. - Check the hot-gas bypass valve.

Trouble	Classification of Likely Causes	Sub-Classification	Check and Remedy
Insufficient heating	5) Engine speed does not increase (during a mode such as error avoidance control).	[1] High-pressure error avoidance	- See high-pressure error check items.
		[2] Discharge temperature error avoidance	- See discharge temperature error check items.
		[3] Coolant temperature error avoidance	- See coolant temperature error check items.
		[4] High-pressure error detection └ Refrigerant high-pressure sensor malfunction (Engine speed does not increase since the high-pressure level has been mis-detected as being too high.)	- See "(5) Checking the refrigerant high-pressure sensor" in 3.3.8.
		[5] Insufficiency in engine output └ Engine starts, but it stalls.	- See engine stall check items.
	6) Installation status is not appropriate.	[1] Significant loss of pressure in the piping ├ Piping between indoor and outdoor units is too long. ├ Too many bends are present. ├ Branched piping is too long. └ Piping size is not appropriate.	- Actual length: 100 m (max.) - Equivalent length: 125 m (max.) - Length from the first branch: 40 m (max.)
		[2] Significant difference in elevation	- Between indoor and outdoor units (max.) Outdoor unit upper: 50 m Outdoor unit lower: 40 m
		[3] Piping branches ├ The branch pipe is not mounted at the correct angle. └ The branched header is further branched.	- Difference in elevation between indoor units: 15 m (max.)
		[4] The total connection capacity of the indoor units is too large.	- Approx. 130% or less (Capability decreases in proportion to the excess amount of capacity.)

MAINTENANCE OF MAJOR FUNCTIONAL COMPONENTS

Chapter 4

MAINTENANCE OF MAJOR FUNCTIONAL COMPONENTS

4.1 Engine Body Replacement

(1) Components, tools, and materials required

Description		Part No.	Qty.
Components	Engine assy set	622041-33020	1
	Aisin Coolant S	G0954-3252	1
	Aisin Gas Engine Oil L-10000	622461-30010	4
Tools	Hose clipper	—	
	Belt tension gauge	—	
	Timing light	—	
	Torque wrench	—	
	Wooden piece	—	

(2) Disassembly procedure

[1] Remove the compressor belt.

[2] Drain the engine oil. See Fig. 1.

1) Clamp the engine - oil sub tank oil hose using hose clippers.
2) Remove the plug of the oil pan and drain the oil using an oil changer. Or remove the joint and drain the oil.
3) Also, drain out the oil from the oil sub-tank similarly.
4) Remove the engine - oil sub-tank oil hosing (3 pieces) from the engine.

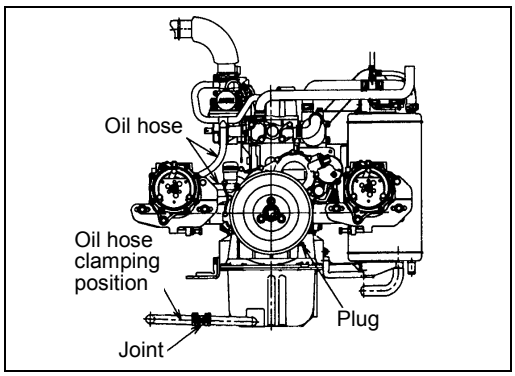


Fig. 1

[3] Drain the coolant. See Figs. 2 and 3.

1) Clamp the coolant hosing in two places.
2) Loosen the coolant drain plug and drain the coolant.
3) Remove the coolant hosing (2 pieces) from the engine.

[4] Remove the harness. See Figs. 2 and 3.

1) Starter (2 places)
2) Gas mixer (2 places)
3) Engine speed sensor
4) Engine oil pressure switch
5) Ignition coil (3 places)
6) Coolant temperature sensor

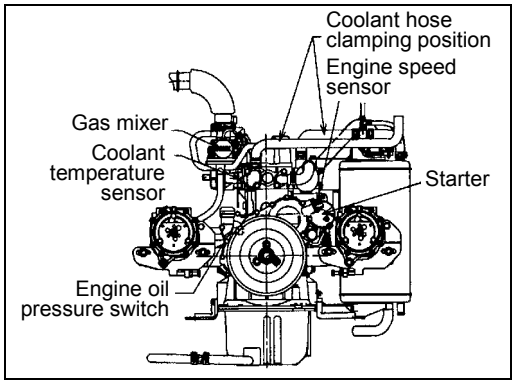


Fig. 2

[5] Remove the exhaust heat exchanger. See Fig. 4.

Loosen the bolts on the exhaust pipe and exhaust heat exchanger mounting stay, and remove the exhaust heat exchanger.
When removing the exhaust heat exchanger, suspend it with strings or other slings. Otherwise, the exhaust heat exchanger will be unstable.

[6] Remove the compressor. See Fig. 4.

1) Suspend the compressor with strings or other slings.
2) Remove the bracket mounting bolts and remove the compressor together with the bracket from the engine.

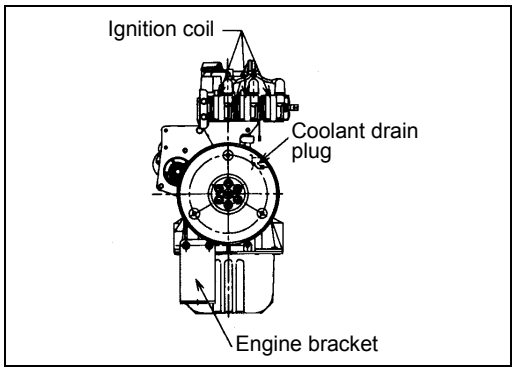


Fig. 3

[7] Remove the engine. See Fig. 4.

1) Remove the air suction hose.
2) Remove the oil pan from the bottom of the engine.
3) Insert a wooden piece (about 20 mm thick) under the engine.
4) Remove the engine brackets (3 pieces) and then remove the engine by pulling it to the front.

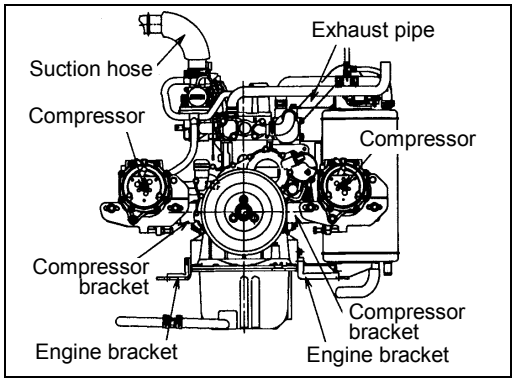


Fig. 4

[8] Check the compression is the specific value or more by the compression gauge.

The specific pressure = 1.4 MPa or more

[9] After removing the hose clipper, open the radiator cap and fill the radiator with the coolant.

Condensation of coolant = 65 % (Volumetric concentration)

[10] After operating the coolant pump with the “Check mode #34, water filling mode, check the amount of coolant in the radiator cap and, if the water level is lower, fill it with the coolant.

[11] Until not checking the decline of the water level like in [10], repeat the performance in the [10]

[12] Operate the engine and check the oil leakage, water leakage and other errors.

(3) Reassembly procedure

[1] Connect the gas mixer, the exhaust manifold, the compressor pulley, and the blowby hose to a new engine. Replace the gaskets of the gas mixer and exhaust manifold.

Compressor pulley tightening torque: 39 N·m

[2] Mount the engine in the reverse order to that of removal.
Replace the gasket of the exhaust pipe with a new one.

Note:
When placing the engine on the ground, lay out waste cloths and slowly rest the engine on them taking care not to damage the bottom of the oil pan.

Compressor belt tension: 550 N to 600 N

[3] After removing all hose clippers, open the radiator cap and add coolant until the radiator has become full.

Coolant concentration: 65% (Volumetric concentration)

[4] Add the specified amount (35 liters) of new engine oil from the oiling port of the oil sub-tank.

[5] After driving the coolant pump in “Check Mode - #34 Refilling Mode” of the maintenance board, open the radiator cap and check the coolant level in the radiator. Refill the radiator if the coolant level is too low.

[6] Repeat step [5] above until the coolant level in the radiator has stopped decreasing.

[7] Start the engine and check for oil leakage, coolant leakage, and other abnormalities.

[8] Stop the engine and after waiting for at least 10 minutes, pull out the oil level gauge of the oil sub-tank and check the oil level.

Specified amount = FULL level + 0 to 20 mm

4.2 Cylinder Head Replacement

(1) Components, tools, and materials required

Description		Part No.	Qty.
Components	Cylinder head set Aisin Coolant S Aisin Gas Engine Oil L-10000	622043-33020 G0954-3252 622461-30010	1 1 Small quantity
Materials/Others	Gasket remover Waste cloth	— —	
Tools	Hose clipper Scraper (Iron pawl) Belt tension gauge Torque wrench Plug wrench	— — — — —	

(2) Disassembly procedure

[1] Drain the coolant. See Figs. 1 and 2.

1) Clamp the coolant hose in two places.
2) Loosen the coolant drain plug and drain the coolant.
3) Remove the coolant hosing (2 pieces) from the engine.

[2] Remove the harness. See Figs. 1 and 2.

1) Gas mixer (2 places)
2) Ignition coil (3 places)
3) Coolant temperature sensor

[3] Remove the high-tension cords and remove the ignition plugs.

[4] Loosen the three nuts and remove the cylinder head cover.

[5] Loosen the three nuts, then remove the rocker shaft assembly, and remove the stem cap. See Fig. 3.

Note:
Be careful at this time so as not to drop the stem cap into the engine.

[6] Remove the push rods.

Note:
After removing the rods, arrange them in order of removal.

[7] Remove the exhaust heat exchanger stay from the exhaust manifold.

[8] Remove the exhaust pipe.

[9] Remove the air suction hose and the oil hosing.

[10] Loosen the 14 bolts and remove the cylinder head.

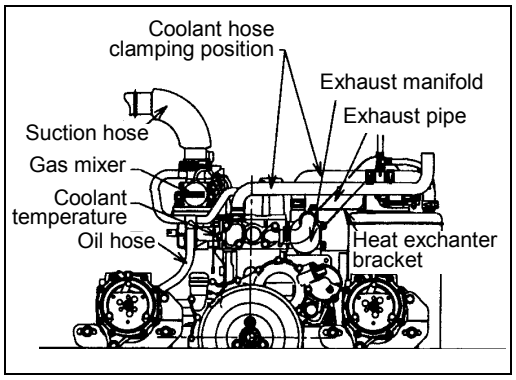


Fig. 1

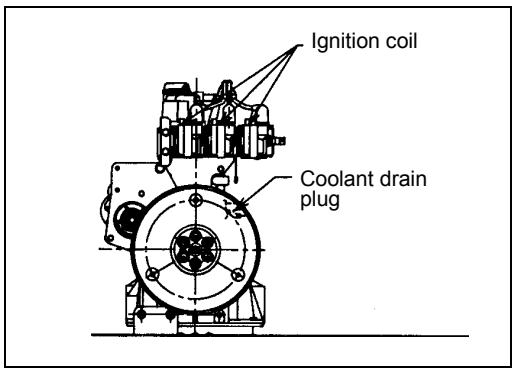


Fig. 2

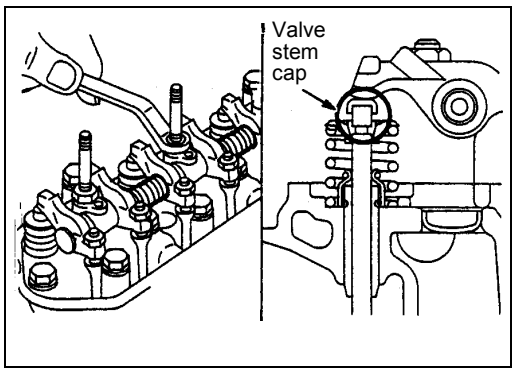


Fig. 3

(3) Reassembly procedure

[1] Mount accessories in/on a new cylinder head. See Fig. 4.

1) Intake manifold (Replace the gasket.)
2) Exhaust manifold (Replace the gasket.)
3) Ignition coils (The #2 coil has bolts at its reverse side as well.)
4) Water inlet and water outlet (Replace the gasket.)
5) Hosing
6) Stud bolts

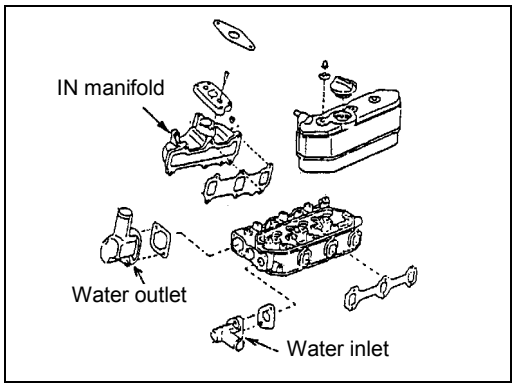


Fig. 4

[2] Remove all fragments of the old gasket and dirt from the surface of the cylinder block using a scraper and a gasket remover.

Notes:
1. Do not allow dirt to enter the oiling port, the coolant holes, or the boltholes.
2. Use a gasket remover only for metallic sections.
3. If the bolts are tightened with the boltholes filled with oil or coolant, the resulting overflow may deteriorate the seal ability of the gasket. Before tightening the bolts, therefore, be sure to wipe with a waste cloth.

[3] Place the gasket on the cylinder head and then mount the cylinder head. Tighten the 14 bolts in the numerical order shown in Fig. 6, and in two split operations. See Figs. 5 and 6.

Tightening torque: 34 N·m

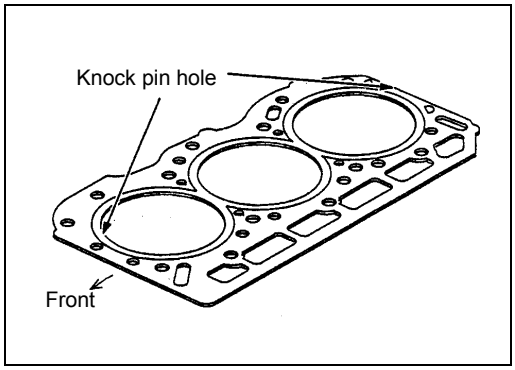


Fig. 5

[4] Insert the push rods in the order that they were removed.

[5] Mount the stem cap on the valve and then mount the rocker shaft assy. See Fig. 7.

Note:
Tighten the nut so that the adjust screw fits into the cup of the push rod.

Rocker shaft assembly fastening torque:20 N·m

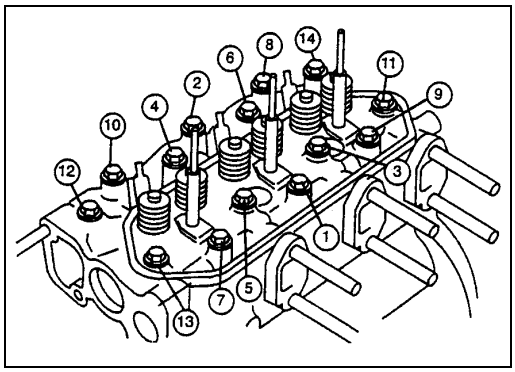


Fig. 6

[6] Adjust the valve clearance.

Clearance adjustment value: 0.25 ± 0.05 mm

[7] Remount the following removed parts:

1) Head cover
2) Air suction hose and oil hosing
3) Exhaust pipe (replace the gasket)
4) Exhaust heat exchanger stay
5) Ignition plugs and high-tension cords
6) Harness (Gas mixer, ignition coils, and coolant temperature sensor)
7) Coolant hosing

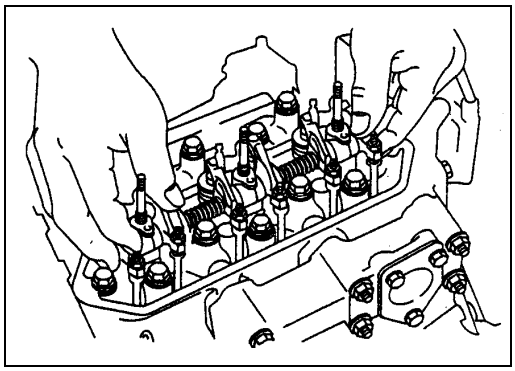


Fig. 7

[8] Measure compression force using a compression gauge.

Specified compression force: 1.4 MPa or more

[9] After removing all hose clippers, open the radiator cap and add coolant until the radiator has become full.

Coolant concentration: 50% (Volumetric concentration)

[10] After driving the coolant pump in “Check Mode - #34 Refilling Mode” of the maintenance board, open the radiator cap and check the coolant level in the radiator. Refill the radiator if the coolant level is too low.

[11] Repeat step [10] above until the coolant level in the radiator has stopped decreasing.

[12] Start the engine and check for oil leakage, coolant leakage, and other abnormalities.

4.3 Compressor Replacement

(1) Components, tools, and materials required

Description		Part No.	Qty.
Components	Compressor Assy (Spare parts kit) Dryer filter	R (variable): 623404-11010 L (fixed): 621030-11010 623187-30010	1 1
Materials	R407C NL10	— —	
Tools (except general-purpose tools)	- Vacuum pump - Weightometer - Gauge manifold - Belt tension gauge - Digital temperature gauge	— — — — —	

(2) Disassembly procedure

[1] Remove the compressor.

[2] Remove the compressor with the bracket mounted, and then remove the compressor from the bracket.

(3) Reassembly procedure

[1] Assemble a new compressor bracket.

[2] Remove the port cover of the compressor, and mount new O-rings in the grooves.

Note:
Coat new O-rings with new refrigerator oil, and mount the O-rings taking care so as not to damage them.
– Inlet side
24.4 mm in inside diameter, 2.3 mm in wire diameter
– Outlet side (reducing side)
17.4 mm in inside diameter, 2.3 mm in wire diameter

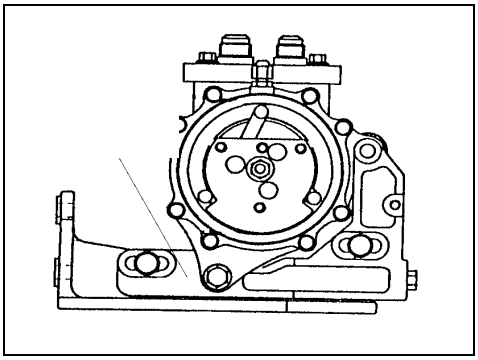


Fig. 1

[3] Add the required amount of new refrigerator oil from the inlet and outlet ports. See Fig. 2

Refrigerator oil	Amount of oil to be added (for 621030-11020 and 621030-11030)
NL10	Inlet: 50 cm^3, Outlet: 150 cm^3

Note:

Refrigerator oil can be easily added by performing this while manually rotating the clutch plate.

[4] Place the inlet and outlet ports on the compressor, and tighten bolts to the required torque in the required order (diagonally).

Bolt tightening torque: 19.6 to 24.5 N·m

Note:
When remounting the ports, take care so as not to damage the O-rings.

[5] Mount the new bracket to compressor into the position. Mount the belt and adjust belt tension.
After this, rotate the compressor through several full turns by hand and check for appropriate belt tension.

Belt tension: 550 to 600 N (New belt)
450 to 500 N (After mounting)

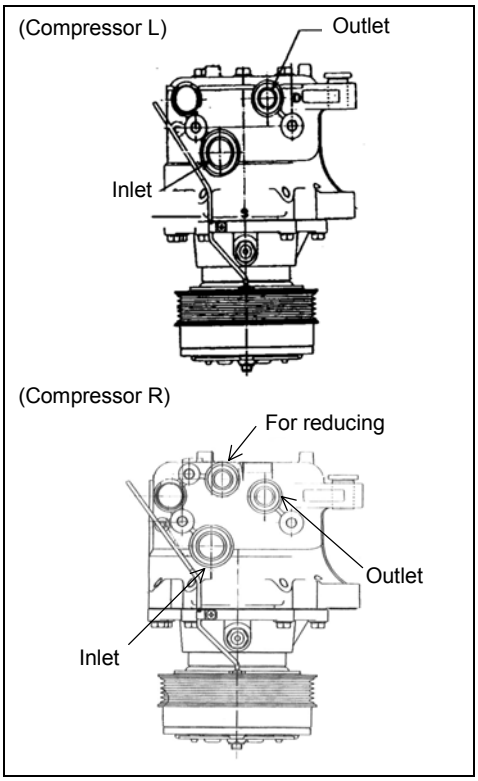


Fig. 2

[6] After making sure of no refrigerator oil leakage, execute at least one hour of vacuum pumping.

When replacing the variable capacity compressor, vacuum the amount adjustment valve with the maintenance board functions like check mode after 1000 Steps or more.

[7] Recharge the compressor with refrigerant and refrigerator oil up to the required level.

Factory-preset amount of charging: 13 kg

Recharge (kg) = $(L_1 \times 0.12) + (L_2 \times 0.06) + (L_3 \times 0.03)$
Where L_1: Overall length (m) of 12.7mm-diameter liquid pipeline
L_2: Overall length (m) of 9.52 mm-diameter liquid pipeline
L_3 Overall length (m) of 6.35 mm-diameter liquid pipeline

Notes:
When adding refrigerator oil, refer to the section of the MAINTENANCE DATA STANDARDS that describes the compressor circuit.

[8] After charging the compressor with refrigerant, check the operation of the compressor by measuring the refrigerant high pressure, low pressure, and temperature.

PERIODIC MAINTENANCE

Chapter 5

PERIODIC MAINTENANCE

5.1 Periodic Maintenance Items and Periods

Periodic maintenance and part replacement are required for continued normal operation of the gas heat pump air-conditioning system.
The recommended periodic maintenance and part replacement items for 2,000 hours of operation on an annual basis are listed in the table below. For more hours of annual operation, conduct these items at least every 10,000 hours.

⚠ WARNING

Be absolutely certain to perform the following operations before starting periodic maintenance operations:

– Turn off the 200-V ground leakage circuit breaker located inside the control box of the outdoor unit. Before turning off the breaker, stop remote-controlled operation and wait for at least about one minute.

– Close the main plug on the fuel line.

No.	Item To Be Performed	Frequency of maintenance (No. of years)	
		5	10
1	Changing engine oil	■	■
2	Replacing the oil filter	■	■
3	Replacing an ignition plug	■	■
4	Replacing the air element	■	■
5	Checking and replacing the compressor belt	■	■
6	Checking the coolant level and adding coolant and coolant reinforcement	□	□
7	Checking for engine oil leakage	□	□
8	Checking for coolant leakage	□	□
9	Checking for exhaust gas leakage	□	□
10	Checking for fuel gas leakage	□	□
11	Checking the compressor	□	□
12	Checking for refrigerant leakage	□	□
13	Checking for operating sound*	□	□
14	Prevention of valve damage*	◆	◆
15	Replacing the gas hose.	—	■
16	Checking and adjusting the valve clearance	□	□

Notes:

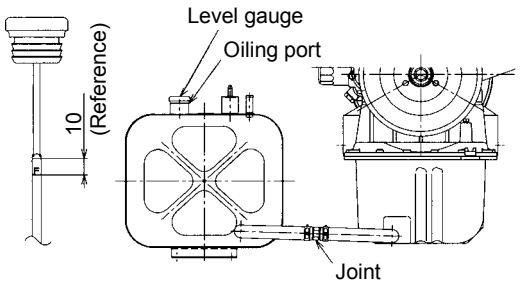
1. After test operation or checking, at five years on a calendar basis or 10,000 hours of actual operation, whichever comes the first, perform maintenance and check operations, subject to the above table.
2. The ■ mark and □ mark in the table denote replacement and check (adjustment) respectively. Items marked "*" need to be performed with the system running.
3. The ◆ mark indicates that carburetor cleaning is required.
4. For the items that require only all-year checking, replace parts when abnormality is detected in the checking operations.
5. Refill the reservoir with the specified amount of coolant-strengthening agent. Use Aisin Coolant S (G0954-3252) of the required concentration to compensate for insufficiency. The required concentration is 65 to 75 percent (coolant: 0.7, water: 0.3), which is equivalent to a concentration of 53 to 60 percent in the case of measurement with an optical concentration meter.
6. Use Aisin Engine Oil L-10000 to add engine oil.

5.2 Periodic Maintenance Procedures

5.2.1 Changing Engine Oils

[1] Operate the engine for about 5 minutes before changing the oil.

[2] After stopping the engine, pull out the level gauge from the oil sub-tank and then drain the oil using an oil changer. Or after clamping the hosing across the joint by use of hose clippers and removing the joint, drain the oil and then return the joint to the original position.



[3] Add the specified amount (35 liters) of new engine oil from the oiling port of the oil sub-tank.

[4] After operating the engine for about 3 minutes, stop the engine and after about 3 minutes, confirm the oil level using the oil level gauge.

⚠ CAUTION

- Be sure to use Aisin-specified oil L10000.
- Keep oils away from belting and pulleys.
- When clamping the hosing at the joint, confirm the traces of clamping on the hosing and mount it properly at its original position.

Changing period	At least every 5 years (or 10,000 hours)
Oil level	F + 0 to 10.0 mm(20□) F +18 to 9 mm (90□)

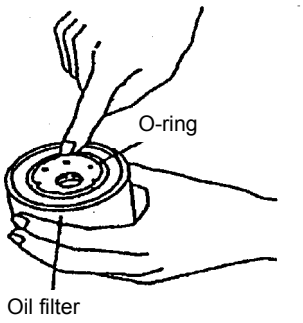
5.2.2 Replacing the Oil Filter

[1] Remove the oil filter using an oil filter wrench. Wipe off the dripped oil with a waste cloth.

[2] Apply engine oil to the surface of the O-ring in a new oil filter, and be sure to hand-mount the filter securely.

Changing period: At least every 5 years (or 10,000 hours)

Tool required: Oil filter wrench



5.2.3 Replacing an Ignition Plug

[1] Hold the cap of the corresponding high-tension cord and remove the cap. Next, remove the ignition plug using a plug wrench.

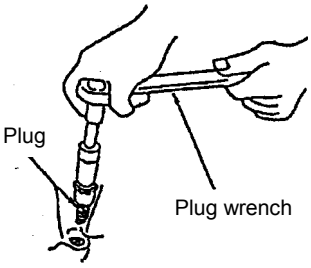
[2] Mount a new ignition plug; hand-fasten it first and then refasten with a plug wrench.

[3] Confirm the identification number of the high-tension cord and mount the cap properly.

Changing period: At least every 5 years (or 10,000 hours)

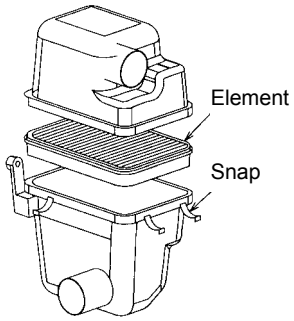
Tightening torque: 20 to 25 N·m

Tool required: Plug wrench



5.2.4 Replacing the Air Element

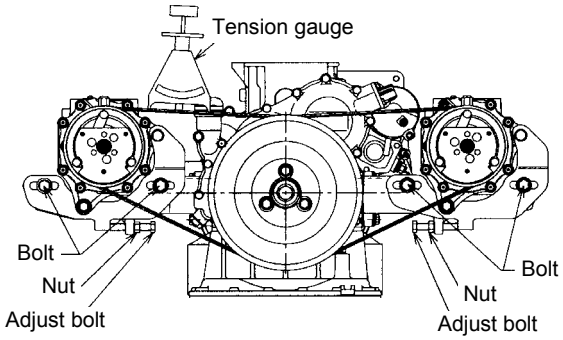
[1] Release the four snaps of the air cleaner and then remove the old element.
[2] Mount a new element.
Mount the element so that the top faces upward.
[3] Fasten the four snaps of the air cleaner.



Changing period:	At least every 5 years (or 10,000 hours)

5.2.5 Replacing the Compressor Belt

[1] Loosen the bolts, nuts, and adjust bolts to remove the belt.
[2] Mount new belt.
[3] Adjust belt tension using the adjusting bolts, and fasten the nut.
[4] Retighten the bolts.
[5] Rotate the engine pulley through several full turns by hand and then check for appropriate belt tension.



Reference belt tension:	550 to 600 N

Compressor belt changing period:	At least every 5 years (or 10,000 hours)

Tool required: Oil filter wrench: Offset wrenches (12 mm, 14 mm)
Belt tension gauge

5.2.6 Adjusting the Valve Clearances

[1] Remove the head cover.

[2] Match the crank pulley to the top dead center mark as shown in the view.

[3] Make sure that when the crank pulley is rotated by about 20 degrees horizontally, the IN rocker arm of the #1 cylinder does not move. If the rocker arm moves, rotate the crank pulley through one full turn for matching to the top dead center.

[4] Loosen the adjust nuts on the #1 and #3 intake cylinders and the #1 and #2 exhaust cylinders as shown, and adjust each cylinder.

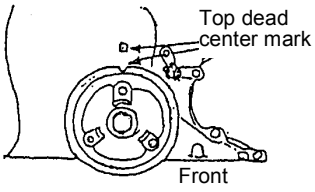
[5] Rotate the crank pulley through 360 degrees.

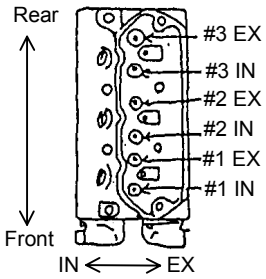
[6] Loosen the adjust nuts on the #2 intake cylinder and the #3 exhaust cylinder as shown, and adjust both cylinders.

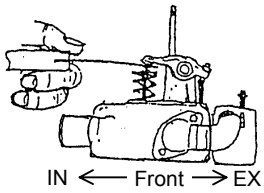
Reference clearance: 0.35 ± 0.05 mm (hot status)

Notes:

1. Do not use thickness gauges of 0.2 mm or more. To adjust clearances of 0.2 mm or more, be sure to use two appropriate gauges in overlapped form.
2. Do not use corroded or bent thickness gauges.
3. When the engine is not cold enough, perform adjustments for a valve clearance that permits a 0.33-mm gauge to be inserted and does not permit a 0.38-mm gauge to be inserted.

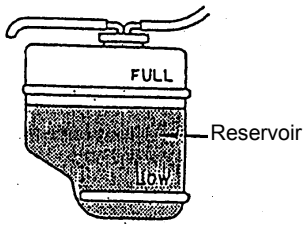






5.2.7 Adding Coolant and Coolant reinforcement Agent

[1] Refill the reservoir with the specified amount of coolant-strengthening agent. If the specified amount of refilling is likely to cause the FULL level to be exceeded, drain out the coolant from the reservoir beforehand.



Frequency of addition	At least every 5 years (or 10,000 hours)
Specified amount	280 to 330 cm^3

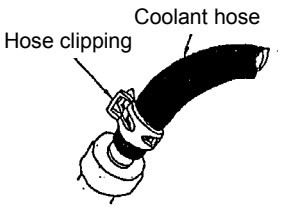
[2] Add coolant until the FULL coolant level in the reservoir has been reached.

⚠ CAUTION

- Be absolutely certain to use the specified Aisin coolant reinforcement.
- To add coolant, always use “Aisin Coolant S”.
- Add coolant at a concentration from 50vol% to 60vol%.

5.2.8 Checking the Coolant Hosing

Check the coolant hosing (6 pieces) for cracking, deterioration, loose hose clipping, coolant leakage, and other unusual states

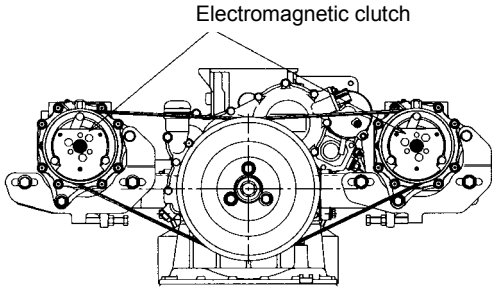


5.2.9 Checking the Compressor

[1] Check that the compressor does not generate unusual sounds during operation.

[2] Make sure that when the electromagnetic clutch is disengaged, the shaft of the compressor does not rotate synchronously.

[3] After stopping the engine, rotate the shaft by hand and check that it rotates smoothly.



5.2.10 Checking the Operational Sounds

[1] Check that the outdoor unit does not generate unusual sounds during operation.

[2] Listen very carefully for rattling sounds from the cylinder head and for interference sounds from rotating sections around the engine.

5.2.11 Prevention of Valve Damage

Cleaning with a valve cleaner

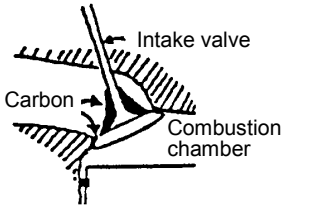
[1] Disconnect the mixer - T pipe blowby hose from the T pipe.

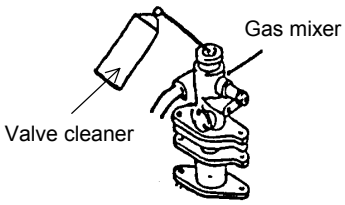
[2] Start the engine.

[3] Inject about a half can of valve cleaner from the disconnected blowby hose into the mixer. Perform the injection intermittently with care so as not to allow the engine to stall or to overspeed.

[4] Reconnect the hose.

[5] Let the engine run until no white smoke has come out from the exhaust trapper, and then stop the engine.





⚠ WARNING

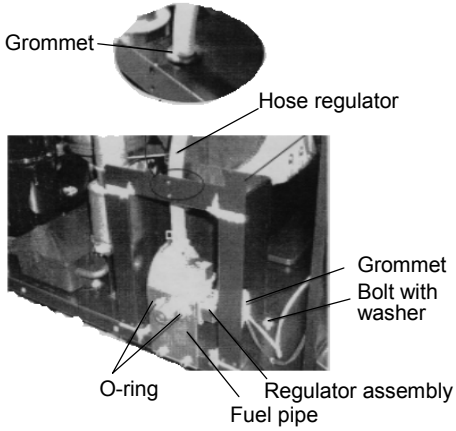
Be extra careful so as not to get your fingers, clothes, etc. caught at the pulley or other rotating bodies when cleaning.

5.2.12 Replacing the Fuel Gas Hose

[1] Remove the hose clipping and disconnect the fuel gas hose.

[2] Remount the hose clipping to connect a new hose.

Changing period:	At least every 10 years (or 20,000 hours)



MAINTENANCE DATA STANDARDS

Chapter 6

MAINTENANCE DATA STANDARDS

Note: Specifications without Model number of the outdoor unit are common to all models.

6.1 Engine-Related Components

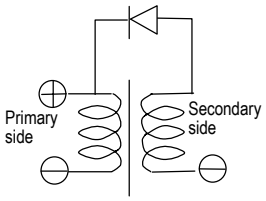
<table>
<tr><th>Item</th><th colspan="2">Standard Value</th><th>Remarks</th></tr>
<tr><td>Engine speed</td><td colspan="2">
<table>
<tr><td rowspan="2">22.4 kW</td><td rowspan="2">P224**P
P224**N</td><td>Cooling</td><td>1200 - 1600</td><td rowspan="6">min^{-1}</td></tr>
<tr><td>Heating</td><td>1200 - 2150</td></tr>
<tr><td rowspan="2">28 kW</td><td rowspan="2">P280**P
P280**N</td><td>Cooling</td><td>1200 - 1800</td></tr>
<tr><td>Heating</td><td>1200 - 2550</td></tr>
<tr><td rowspan="2">35.5 kW</td><td rowspan="2">P355**P
P355**N</td><td>Cooling</td><td>1200 - 2450</td></tr>
<tr><td>Heating</td><td>1200 - 2550</td></tr>
</table>
</td><td></td></tr>
<tr><td rowspan="2">Compression system</td><td>Valve clearance</td><td>
<table>
<tr><td></td><td>Hot status</td><td>Cold status</td><td>Tolerance</td></tr>
<tr><td>IN</td><td>0.35</td><td>0.25</td><td rowspan="2">± 0.05 mm</td></tr>
<tr><td>EX</td><td>0.35</td><td>0.25</td></tr>
</table>
</td><td>After stopping the engine being warmed up, perform measurements within 30 minutes.</td></tr>
<tr><td>Compression</td><td>
<table>
<tr><td>Cylinder</td><td>1.4 or more</td><td rowspan="2">MPa</td></tr>
<tr><td>Limit</td><td>1.1</td></tr>
</table>
</td><td>Engine speed of at least 300 min^{-1} (cranking)</td></tr>
<tr><td rowspan="3">Ignition system</td><td>Ignition timing</td><td>
<table>
<tr><td>Ignition timing</td><td>16 ± 3°/1200 min^{-1}</td></tr>
</table>
</td><td>Adjustment impossible</td></tr>
<tr><td>High-tension cord resistance value</td><td>
<table>
<tr><td>Cylinder #1</td><td>5.7 ± 2.2</td><td rowspan="3">kΩ</td></tr>
<tr><td>Cylinder #2</td><td>4.6 ± 1.8</td></tr>
<tr><td>Cylinder #3</td><td>3.5 ± 1.3</td></tr>
</table>
</td><td></td></tr>
<tr><td>Ignition plug</td><td>
<table>
<tr><td>Gap</td><td>0.4 to 0.1</td><td>mm</td></tr>
<tr><td>Tightening torque</td><td>20 to 25</td><td>N·m</td></tr>
</table>
</td><td></td></tr>
<tr><td rowspan="2">Fuel system</td><td>Idling fuel adjustment (O_2 value)</td><td>
<table>
<tr><td>O_2 value</td><td>3 to 10 %/1800 min^{-1}</td></tr>
</table>
</td><td></td></tr>
<tr><td>Fuel gas pressure</td><td>
<table>
<tr><td>Propane</td><td>2.8</td><td rowspan="2">kPa</td></tr>
<tr><td>13A</td><td>2.0</td></tr>
</table>
</td><td></td></tr>
</table>

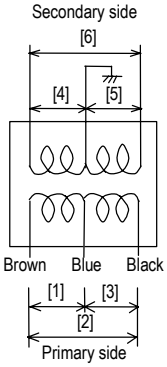
Item		Standard Value	Remarks
Lubricant system	Engine oil pressure pump	Relief valve: 0.49 MPa	
	Engine oil amount	Type: Aisin GHP Oil L10000 (10 L can) Sealing amount: 35 L	Including oil for the oil filter
Belt tension	Compressor belt	Initial setting: 550 to 600* After mounting: 450 to 500 * Manually rotate the engine pulley several times before measuring initial compressor belt tension	.
Tightening torque	Cylinder head bolt	34 N·m	Use torque wrench without fail.
	Compressor pulley bolt	39 N·m	
	Engine pulley bolt	88 N·m	
	Valve rocker shaft nut	19 N·m	
	Cylinder head cover	5.4 N·m After hand-tightening at 2.5 N·m	
	Water drain bolt	12.7 N·m	

6.2 Refrigerant-Related Components

<table>
<tr><th>Item</th><th>Standard Value</th><th>Remarks</th></tr>
<tr><td>Compressor oil (Refrigerator oil)</td><td>
<table>
<tr><td>NL10</td><td>Outdoor unit body</td><td>4 L</td></tr>
</table>
</td><td></td></tr>
<tr><td>Refrigerant gas</td><td>
<table>
<tr><td>Type</td><td>R407C</td></tr>
<tr><td>Sealing amount</td><td>13 kg</td></tr>
<tr><td>Recharge (kg)</td><td>(L_1 × 0.12) + (L_2 × 0.06) + (L_3 × 0.03)</td></tr>
</table>
L_1: Overall length (m) of 12.7 mm-diameter liquid pipeline
L_2: Overall length (m) of 9.52 mm-diameter liquid pipeline
L_3: Overall length (m) of 6.35 mm-diameter liquid pipeline
</td><td></td></tr>
<tr><td>Refrigerant piping length and permissible difference in elevation</td><td>
<table>
<tr><td>Piping length</td><td colspan="2">120 (Equivalent length)
100 (Actual length)</td><td rowspan="4">m</td></tr>
<tr><td rowspan="2">Between indoor and outdoor units</td><td>Outdoor unit lower</td><td>40</td></tr>
<tr><td>Outdoor unit higher</td><td>50</td></tr>
<tr><td>Between indoor units</td><td colspan="2">15</td></tr>
</table>
For details see the Installation Manual.
</td><td></td></tr>
<tr><td>Refrigerant pipe diameters</td><td>
<table>
<tr><td></td><td>P224</td><td>P280</td><td>P355</td></tr>
<tr><td>Liquid pipe (mm)</td><td>ϕ12.7</td><td>ϕ12.7</td><td>ϕ12.7</td></tr>
<tr><td>Gas pipe (mm)</td><td>ϕ25.4</td><td>ϕ28.58</td><td>ϕ31.8</td></tr>
</table>
</td><td></td></tr>
<tr><td>Flare nut torque values</td><td>
<table>
<tr><td>Refrigerant pipe</td><td>OD (mm)</td><td>Nominal diameter (in.)</td><td colspan="2">Flare nut tightening torque</td></tr>
<tr><td rowspan="3">Liquid pipe</td><td>6.35</td><td>1/4</td><td>15 to 20</td><td rowspan="6">N·m</td></tr>
<tr><td>9.52</td><td>3/8</td><td>34 to 39</td></tr>
<tr><td>12.70</td><td>1/2</td><td>49 to 54</td></tr>
<tr><td rowspan="3">Gas pipe</td><td>12.70</td><td>1/2</td><td>49 to 54</td></tr>
<tr><td>15.88</td><td>5/8</td><td>59 to 64</td></tr>
<tr><td>19.05</td><td>3/4</td><td>76 to 81</td></tr>
</table>
</td><td></td></tr>
<tr><td>Quantities of refrigerator oil to be added during the repair of refrigerant-related sections</td><td colspan="2">
<table>
<tr><th colspan="2">Description</th><th>Quantity</th></tr>
<tr><td colspan="2">During replacement of the discharge tubing, the expansion valve, the filter dryer, or other consumable parts in which the refrigerator oil does not accumulate</td><td>100 cc</td></tr>
<tr><td colspan="2">During release of waste refrigerant gas</td><td>100 cc</td></tr>
<tr><td rowspan="2">During replacement of compressor (filter dryer included)</td><td>When refrigerant pipe interior is not to be cleaned</td><td>0 cc</td></tr>
<tr><td>When refrigerant pipe interior is to be cleaned</td><td>1000 cc</td></tr>
<tr><td rowspan="3">Independent replacement
(If replacement is made with that of other components, add oil considering other quantities of addition.)</td><td>During replacement of accumulator</td><td>Residual quantity + 500 cc</td></tr>
<tr><td>During replacement of oil separator</td><td>Residual quantity + 500 cc</td></tr>
<tr><td>During replacement of other components (other than compressor)</td><td>Quantity actually required</td></tr>
</table>
</td></tr>
</table>

6.3 Electrical Equipment

<table>
<tr><th>Item</th><th colspan="5">Standard Value</th><th>Remarks</th></tr>
<tr><td rowspan="2">Coil resistance value
(Reference value)</td><td rowspan="2">Outdoor unit system</td><td colspan="5">
<table>
<tr><td colspan="2">Gas-operated solenoid valve coil</td><td>21 Ω</td></tr>
<tr><td colspan="2">Four-way valve coil</td><td>1.3 kΩ ± 20%</td></tr>
<tr><td rowspan="2">Ignition coil (Primary side)</td><td>Cold status</td><td>2.2 to 3.4 Ω (–10 to 50°C)</td></tr>
<tr><td>Hot status</td><td>2.8 to 4.4 Ω (50 to 100°C)</td></tr>
<tr><td colspan="2">Cam angle sensor</td><td>1100 ± 150 Ω (20°C)</td></tr>
<tr><td colspan="2">Compressor clutch coil</td><td>4 Ω</td></tr>
<tr><td rowspan="3">AC/DC converter trans-former</td><td rowspan="3">Primary side</td><td>Brown - Blue (1) → 0.5 Ω</td><td rowspan="3">Secondary side</td><td>(4) → 0.2 Ω</td></tr>
<tr><td>Brown - Black (2) → 0.6 Ω</td><td>(5) → 0.1 Ω</td></tr>
<tr><td>Blue - Black (3) → 0.3 Ω</td><td>(6) → 0.1 Ω</td></tr>
<tr><td colspan="2">Board relay (R2/R3)</td><td>170 Ω</td></tr>
</table>
</td><td>Ignition coil
 

Transformer for AC/DC converter
 
</td></tr>
<tr><td>Motor coil resistance value
(Reference value)</td><td>Indoor unit drain pump</td><td colspan="5">
<table>
<tr><td>4-/3-/2-way cassette type (TKT)*</td><td>212 Ω</td></tr>
<tr><td>2-way cassette type (TKTW)*</td><td>212 Ω</td></tr>
<tr><td>1-way cassette type (TKTS)*</td><td>136 Ω</td></tr>
<tr><td>Built-in cassette type (TKR)*</td><td>136 Ω</td></tr>
<tr><td>Medium static-pressure duct type (TKUM)*</td><td>327 Ω</td></tr>
</table>
</td><td>*Common to all models</td></tr>
</table>

Indoor Unit Fan Motor Resistance Value

(1) 4-/3-/2-way blowoff cassette type (TKT) (Unit: Ω)

Model	Motor Model No.	Sub	Main 1	Main 2	Main 3	Main 4
P28, P36, P45	SSA511A624A	251.8	165.0	68.5	48.0	48.0
P56	SSA511A625A	246.8	221.5	37.7	31.9	50.0
P71	SSA511A626A	261.9	165.0	52.2	72.5	34.5
P80	SSA511A627A	155.0	175.1	72.6	36.3	36.3
P90, P112	SSA511A628A	57.5	56.8	29.7	13.7	25.1
P140	SSA511A629A	49.3	46.5	21.1	14.0	21.2
P160	SSA511A630A	43.1	34.5	31.5	6.3	21.0

(2) 4-/3-/2-way blowoff compact cassette type (TKTC) (Unit: Ω)

Model	Motor Model No.	Sub	Main 1	Main 2	Main 3	Main 4
P22 to P56	SSA511T094	106.0	172.0	62.0	35.0	26.0

(3) 2-way blowoff cassette type (TKTW) (Unit: Ω)

Model	Motor Model No.	Sub	Main 1	Main 2	Main 3	Main 4
P22 to P56	SSA511T094A	106.0	172.0	62.0	35.0	26.0
P71	SSA511A486CJ	88.6	90.7	46.3	46.3	46.3
P80, P90	SSA511A486B	76.5	134.9	60.5	60.5	60.5
P112	SSA511A486AJ	102.3	69.5	25.5	35.0	35.0
	SSA511A487AJ	76.5	134.9	60.5	60.5	60.5
P140	SSA511A486J	54.3	47.3	34.6	44.0	44.0
	SSA511A487J	101.0	129.2	49.8	71.2	71.2
P160	SSA511A486AJ	102.3	69.5	25.5	35.0	35.0
	SSA511A487J	101.0	129.2	49.8	71.2	61.2

(4) 1-way blowoff cassette type (TKTS) (Unit: Ω)

Model	Motor Model No.	Sub	Main 1	Main 2	Main 3	Main 4
P28, P36	SSA511A422J	291.8	158.4	37.8	18.9	18.9
P45, P56	SSA511A305J	69.8	143.0	47.4	47.4	47.4
P71	SSA511A303J	69.2	120.3	64.8	64.8	64.8

(5) Built-in cassette type (TKR) (Unit: Ω)

Model	Motor Model No.	Sub	Main 1	Main 2	Main 3	Main 4
P22	SSA511A390	98.1	115.9	9.5	9.5	9.5
P28, P36	SSA511A366J	17.9	34.7	14.5	14.5	14.5
P45, P56	SSA511A349J	83.0	57.1	11.5	11.5	11.5
P71	SSA511A350J	17.9	39.2	14.5	14.5	14.5
P90	SSA511A350AJ	17.9	34.7	14.5	14.5	14.5
P112	SSA511A351J	17.9	39.2	14.5	14.5	14.5
	SSA511A352J	83.0	74.0	11.5	11.5	11.5
P140	SSA511A351AJ	17.9	34.7	14.5	14.5	14.5
	SSA511A352AJ	83.0	57.1	11.5	11.5	11.5

Indoor Unit Fan Motor Resistance Value

(6) Ceiling-embedded high static-pressure duct type (TKU) (Unit: Ω)

Model	Motor Model No.	Sub	Main 1	Main 2
P45 to P56	SSA511A471J	35.6	36.3	7.0
P71 to P90	SSA511A358J	35.6	23.7	7.0
P112	SSA511A359J	35.6	16.4	3.5
P140	SSA511A360J	12.6	10.0	6.23
P224	SSA511A363J	35.6	16.4	3.5
	SSA511A363J	35.6	16.4	3.5
P280	SSA511A365J	12.6	7.6	4.68
	SSA511A364J	12.6	10.0	6.23

(7) Ceiling-embedded medium static-pressure duct type (TKUM) (Unit: Ω)

Model	Motor Model No.	Sub	Main 1	Main 2	Main 3	Main 4
P22	SSA511A567	17.9	39.2	14.5	14.5	14.5
P28, P36	SSA511A568	17.9	39.2	14.5	14.5	14.5
P45, P56	SSA511A349J	79.5	55.3	21.4	21.4	21.4
P71	SSA511A350J	17.9	39.2	14.5	14.5	14.5
P90	SSA511A350AJ	17.9	34.7	14.5	14.5	14.5
P112	SSA511A352J	83.0	74.0	11.5	11.5	11.5
	SSA511A352AJ	83.0	57.1	11.5	11.5	11.5
P140	SSA511A351J	17.9	39.2	14.5	14.5	14.5
	SSA511A351AJ	17.9	34.7	14.5	14.5	14.5

(8) Ceiling-suspended type (TKE) (Unit: Ω)

Model	Motor Model No.	Sub	Main 1	Main 2	Main 3	Main 4
P36 to P54	SSA511A305J	291.8	158.4	37.8	18.9	18.9
P71	SSA511A303J	242.0	151.8	58.0	58.0	58.0
P90	SSA511A304J	242.0	151.8	58.0	58.0	58.0
P112	SSA511A307J	236.4	102.5	28.6	28.6	28.6
	SSA511A306J	112.9	55.1	9.0	9.0	9.0
P140	SSA511A306J	112.9	55.1	9.0	9.0	9.0
	SSA511A306J	112.9	55.1	9.0	9.0	9.0

(9) Wall-mounted type (TKK) (Unit: Ω)

Model	Motor Model No.	Main	Sub 1	Sub 2	Sub 3
P28, P36	SSA511B060	231.0	75.0	46.8	186.3
P45	SSA511B047F	131.0	39.1	30.5	77.8
P71	SSA511B047H	131.0	62.3	41.9	187.0

(10) Floor-standing lowboy exposed type (TKFL) (Unit: Ω)

Model	Motor Model No.	Main	Sub 1	Sub 2	Sub 3
P28	SSA511B060	231.0	75.0	46.8	186.3
P45, P56	SSA511B047F	131.0	39.1	30.5	77.8
P71	SSA511B047H	131.0	62.3	41.9	187.0

Indoor Unit Fan Motor Resistance Value

(11) Floor-standing lowboy concealed type (TKFU) (Unit: Ω)

Model	Motor Model No.	Main	Sub 1	Sub 2	Sub 3
P28	SSA511T031	130.1	8.5	7.06	56.1
P45, P71	SSA511T031A	72.5	12.1	11.3	28.8

(12) Outside-air processing unit with a direct expansion coil unit (TKSA) (Unit: Ω)

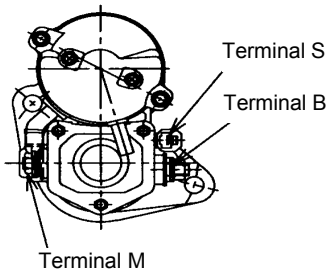
Model	Motor Model No.	Main 1	Main 2	Main 3	Sub
P28	PCH511K007	9.9	13.6	45.3	22.7
	PCH511K007A	9.9	13.6	45.3	22.7
P45, P56	PCH511K008	5.2	8.4	6.0	3.7
	PCH511K008A	5.2	8.4	6.0	3.7

(13) Intake-air processing unit (TKUS) (Unit: Ω)

Model	Motor Model No.	Sub	Main 1	Main 2
P90	SSA511A393J	20.3	69.8	—
P140	SSA511A394J	12.4	43.2	—

(14) Floor-standing type (TKF) (Unit: Ω)

Model	Motor Model No.	Sub	Main 1	Main 2	Main 3
P80	SSA511A610B	80.0	62.2	6.5	30.8
P140	SSA511A610C	31.6	20.5	7.5	11.3

<table>
<tr><th>Item</th><th></th><th>Standard Value</th></tr>
<tr><td>Motor coil resistance value (reference)</td><td>Indoor unit system</td><td>
<table>
<tr><td rowspan="6">Starter</td><td>S – B</td><td>Infinity</td></tr>
<tr><td>S – M</td><td>0.24 Ω</td></tr>
<tr><td>S – Body ground</td><td>0.24 Ω</td></tr>
<tr><td>B – M</td><td>Infinity</td></tr>
<tr><td>B – Body ground</td><td>Infinity</td></tr>
<tr><td>M – Body ground</td><td>0.01 Ω</td></tr>
</table>


<table>
<tr><td rowspan="3">Outdoor heat exchanger fan motor</td><td colspan="2">FM1</td><td colspan="2">FM2</td></tr>
<tr><td>Black - White</td><td>16.61 Ω ± 10%</td><td>White - Blue</td><td>16.61 Ω ± 10%</td></tr>
<tr><td>Black - Red</td><td>28.36 Ω ± 10%</td><td>Blue - Yellow</td><td>23.67 Ω ± 10%</td></tr>
<tr><td></td><td></td><td>Blue - Red</td><td>28.36 Ω ± 10%</td></tr>
</table>
<table>
<tr><td>Engine room cooling fan motor</td><td>170 Ω</td></tr>
</table>
<table>
<tr><td rowspan="6">Mixer stepping motor</td><td>Red - White</td><td rowspan="4">140 Ω</td></tr>
<tr><td>Red - Orange</td></tr>
<tr><td>Brown - Yellow</td></tr>
<tr><td>Brown - Blue</td></tr>
<tr><td>Yellow - Blue</td><td rowspan="2">280 Ω</td></tr>
<tr><td>White - Orange</td></tr>
</table>
<table>
<tr><td rowspan="6">Mixer fuel valve stepping motor</td><td>B1 – S1</td><td rowspan="4">32 Ω</td></tr>
<tr><td>B1 – S3</td></tr>
<tr><td>B2 – S2</td></tr>
<tr><td>B2 – S4</td></tr>
<tr><td>S1 – S3</td><td rowspan="2">64 Ω</td></tr>
<tr><td>S2 – S4</td></tr>
</table>
</td></tr>
</table>

6.4 Coolant-Related Components

<table>
<tr><th>Item</th><th>Standard Value</th><th>Remarks</th></tr>
<tr><td>Thermostat valve</td><td>Thermostat 1 (Opening start: 62°C)<table><tr><td></td><td>Temperature</td><td>Lift amount</td></tr><tr><td>Opening start</td><td>62°C</td><td>0 mm</td></tr><tr><td>Full-open</td><td>72°C</td><td>6.5 mm</td></tr></table></td><td></td></tr>
<tr><td>Coolant</td><td><table><tr><td colspan="2">Coolant</td><td>Aisin Coolant S (4 L can)</td></tr><tr><td colspan="2">Color</td><td>Green</td></tr><tr><td rowspan="2">Amount</td><td>22.4 kW, 28 kW</td><td>14 L (including reservoir)</td></tr><tr><td>33.5 kW</td><td>15.5 L (including reservoir)</td></tr><tr><td colspan="2">Volumetric concentration</td><td>65 % (–35°C antifreeze liquid)</td></tr></table></td><td></td></tr>
<tr><td>Radiator cap</td><td><table><tr><td>Cap pressure</td><td>49 ± 9</td><td>kPa</td></tr></table></td><td></td></tr>
</table>

6.5 Thermister Characteristics

<table>
<tr><th>Item</th><th>Standard Value</th><th>Remarks</th></tr>
<tr><td>Coolant temperature sensor</td><td>
<table>
<tr><th>Temperature (°C)</th><th>Resistance value (kΩ)</th></tr>
<tr><td>50</td><td>17.6</td></tr>
<tr><td>80</td><td>6.1</td></tr>
<tr><td>100</td><td>3.3</td></tr>
<tr><td>110</td><td>2.5</td></tr>
</table>
</td><td></td></tr>
<tr><td>Outside air temp. sensor
Accumulator inlet temp. sensor
Compressor intake temp. sensor
Heat exchanger gas temp. sensor
Heat exchanger liquid temp. sensor</td><td>
<table>
<tr><th>Temperature (°C)</th><th>Resistance value (kΩ)</th></tr>
<tr><td>–10</td><td>23.7</td></tr>
<tr><td>0</td><td>15.0</td></tr>
<tr><td>10</td><td>9.8</td></tr>
<tr><td>20</td><td>6.5</td></tr>
<tr><td>30</td><td>4.4</td></tr>
<tr><td>40</td><td>3.1</td></tr>
<tr><td>50</td><td>2.2</td></tr>
<tr><td>55</td><td>1.86</td></tr>
<tr><td>60</td><td>1.59</td></tr>
<tr><td>65</td><td>1.36</td></tr>
<tr><td>70</td><td>1.17</td></tr>
<tr><td>75</td><td>1.01</td></tr>
</table>
</td><td></td></tr>
<tr><td>Discharge temp. sensor</td><td>
<table>
<tr><th>Temperature (°C)</th><th>Resistance value (kΩ)</th></tr>
<tr><td>0</td><td>182.9</td></tr>
<tr><td>20</td><td>70.4</td></tr>
<tr><td>40</td><td>29.9</td></tr>
<tr><td>60</td><td>13.9</td></tr>
<tr><td>80</td><td>7.0</td></tr>
<tr><td>100</td><td>3.7</td></tr>
<tr><td>120</td><td>2.1</td></tr>
</table>
</td><td></td></tr>
<tr><td>Indoor air temp. sensor
Indoor heat exchanger temp. sensor</td><td>
<table>
<tr><th>Temperature (°C)</th><th>Resistance value (kΩ)</th></tr>
<tr><td>–10</td><td>29.1</td></tr>
<tr><td>0</td><td>16.8</td></tr>
<tr><td>10</td><td>10.0</td></tr>
<tr><td>20</td><td>6.2</td></tr>
<tr><td>30</td><td>4.0</td></tr>
<tr><td>40</td><td>2.6</td></tr>
<tr><td>50</td><td>1.8</td></tr>
</table>
</td><td></td></tr>
</table>

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If you have any questions, please contact our Customer Service Department.